



ELEVENTH ANNUAL IMSA  
PRESENTATION DAY  
April 28, 1999

**IMSA**

10/4  
ILLINOIS MATHEMATICS AND SCIENCE ACADEMY  
"A Pioneering Educational Community"

ELEVENTH ANNUAL IMSA PRESENTATION DAY  
APRIL 28, 1999

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

**Auditorium**

10:35 - 11:15      MUSICAL COMPOSITION FOR PIANO  
Rachel Mackenzie, Dr. Riva Kuhl

**Academic Pit**

8:30 - 8:45      FABRICATION OF POROUS STRUCTURES USING LAYERED  
MANUFACTURING  
Ashlee Riddle, Dr. Selcuk Guceri, Merve Erdal

8:55 - 9:10      CHARACTERIZATION STUDIES IN FUSED DEPOSITION RAPID PROTOTYPING  
Catherine Kuo, Dr. Selcuk Guceri

9:20 - 9:35      RAPID PROTOTYPING: ROAD CONSISTENCY ANALYSIS  
Kyle Richards, Dr. Selcuk Guceri

9:45 - 10:25      THE STARVED ROCK PROJECT  
Meghan Hall, Claiborne Skinner

10:35 - 11:15      WHERE DO THEY GO FROM HERE? LONGITUDINAL STUDY OF IMSA  
GRADUATES  
Jay Thomas

**Lecture Hall**

9:20 - 10:25      RAPE: MYTHS AND REALITIES  
Amanda Groves, Siris Rivas, Tibeca Rodriguez, Dr. John Sippy, Dr. James Victory

10:35 - 11:15      BIOGRAPHIES OF TWENTIETH CENTURY SCIENTISTS  
Stephanie Allewalt - Batavia High School, Margaret Anderson, Blaine Eubanks,  
Elizabeth Gilbert, Douglas Heintz, Susan Johnson, Noah Lauricella, Nicki Pieart - West  
Aurora High School, Erica Ruddy, John Velazquez - East Aurora High School, Margaret  
Wat, Maria Wilson, Grace Yang, Dr. Neill Clark, Dr. Leon Lederman, Dr. Gregg Sinner,  
Dr. Judy Scheppler

**DORM 1505 / ROOM A25 AND A26**

10:35 - 11:15      GENERAL DEVELOPMENT NETWORK  
Chris Banek, Kent Borecky, Matthew Dietrich, Geoffrey Reedy, Katassa Tenhouse,  
David Walker, Steve Terrell

**A-110**

8:30 - 8:45      STUDY OF GALVANIC CURRENT IN THE FORM OF IONTO- AND  
PHONOPHORESIS  
John Hamman, Kevin Pennington

8:55 - 9:10      INVESTIGATION INTO GOVERNMENT COMPLIANCE WITH THE ILLINOIS  
FREEDOM OF INFORMATION ACT  
Michael Gogliotti, Tammy Graff, Judy Kang, Maliha Mustafa, Theresa Amato, Barbara  
Greenberg, Kate Millett, Laura Sullivan

9:20 - 9:35      POPULATION STRUCTURE OF THE CAPTIVE NORTH AMERICAN MARKHOR  
(*CAPRA FALCONERI*) USING mtDNA SEQUENCING AND MICROSATELLITE  
LOCI  
Clara Chi, Dr. Catherine Ramsey

**A110 (continued)**

- 9:45 - 10:00 TOWARD THE SYNTHESIS OF TETRACYCLIC QUINOLONES: THE SYNTHESIS OF AMINO ACID DERIVED PIPERAZINES  
Christen Klochan, Dr. Robin M. Zavod
- 10:35 - 10:50 RESURGENCE OF DISEASES IN RELATION TO CIVIL DISCORD IN AFRICA  
James Kinzer, Dr. Christian Nokkentved
- 11:00 - 11:15 THEMES IN TWENTIETH CENTURY SHORT STORIES  
Mirjana Jankov, Lawrence Chott

**A-112**

- 8:30 - 8:45 NON RADIOACTIVE LABELING OF K562 TARGET CELLS  
Kiarash Javanmardian, Dr. Carl Waltenbaugh
- 9:20 - 9:35 PHYSICS AND MATERIALS OF SUPER-SIDECUT SKIS  
Aaron Parness, Dr. David Workman, Michael Lindenmeyer
- 10:10 - 10:25 EVOLUTION OF THE HANNAFORD WOODS GREAT BLUE HERON ROOKERY  
Kathy Chen, Julie Dowling, Sunita Jasti, Dr. David Workman
- 10:35 - 11:15 MILITARY MAP READING PROGRAM  
Erich Elsen, Sarah Hoffman, John Sosa, James Bondi

**A-113**

- 8:30 - 8:45 MAGNETIC FIELD INHOMOGENEITIES ASSOCIATED WITH THE ARCHIMEDES SPIRAL COIL GEOMETRY  
Samir Meghani, Akhil Narang, Dr. Alan Feinerman
- 8:55 - 9:10 NON-EVASIVE DETECTION VIA EXTRALUMINAL VIBRO-ACOUSTIC PROPERTIES  
Michael Blitstein, Dr. Thomas J. Royston
- 9:20 - 9:35 ARTERIAL BLOOD PRESSURE DURING SLEEP IN ADULTS WITH UNTREATED OBSTRUCTIVE SLEEP APNEA AND SYSTEMIC HYPERTENSION  
Radhika Narla, Dr. Robert C. Basner
- 9:45 - 10:00 THE SLEEP APNEA SYNDROME: AUTOMATED ANALYSIS VS. VISUAL ANALYSIS  
Hyun Jin Son, David W. Carley, Ph.D.
- 10:10 - 10:25 ACTIVITY LEVELS IN MALE JEWEL WASPS, MATED VS. VIRGIN  
Ryan Inton, B. King
- 10:30 - 10:50 THE EFFECTS OF HYPOXIA ON THE FREQUENCY OF GASP-LIKE RHYTHM GENERATION IN MICE  
Alexa Bisinger, Dr. JM Ramirez
- 11:00 - 11:15 THE PHILOSOPHICAL RAMIFICATIONS OF ARTIFICIAL INTELLIGENCE  
Michael Olson, Jill Sison, Mike Ososky

**A-115**

- 8:30 - 8:45 THE NUMBERS OF WIZARD STREET WITH CHILDREN IN CABRINI GREEN: THE PSYCHOLOGY OF LEARNING  
Amanda Groves, George Colone
- 8:55 - 9:10 IMMUNOLocalIZATION OF GLIAL FIBRILLARY ACIDIC PROTEIN (GFAP), RHODOPSIN, AND GLUTAMINE SYNTHETASE IN LIGHT DAMAGED RETINAS OF CD-1 MICE  
Alice Hsiung, Dr. Vijay Sarthy, Dr. Ying Wang
- 9:20 - 9:35 INVOLVEMENT OF FIBROBLAST GROWTH FACTOR IN PREIMPLANTATION MICE EMBRYOS  
Heidi Kim, Dr. Daniel A. Rappolee

**A115 (continued)**

- 9:45 - 10:00 ASSAYING THE EFFECTS OF FGF ON MOUSE EMBRYONIC STEM CELL DIFFERENTIATION TO MYOCARDIAL CELLS  
Himabindu Vidula, Dr. Daniel A. Rappolee
- 10:10 - 10:25 JAVASCRIPT AS A LEARNING AND TEACHING TOOL  
Matthew Stanislawski, David Stears, David Gossman
- 11:00 - 11:15 COYOTE VOCALIZATIONS  
Kathy Chen, Janessa Stream, John T. Thompson

**A-116**

- 8:30 - 8:45 DETECTION OF FOLLICLE STIMULATING HORMONE RECEPTORS (FSHR) ON HUMAN GRANULOSA CELLS (GC) BY FLOW CYTOMETRY  
Jacqueline McKenna, Dr. Judith Luborsky, Dr. Prakash Thiruppathi
- 8:55 - 9:10 *dek* ONCOGENE FUNCTION IN HUMAN BRAIN TUMORS  
Lynn Paik, Roger A. Kroes, Ph.D., Donna S. Kersey
- 9:20 - 9:35 THE ROLE OF ESTROGEN RECEPTOR- $\alpha$  (*Era*) IN THE DIFFERENTIATION OF FIBROBLASTS INTO SMOOTH MUSCLE CELLS IN THE MOUSE VENTRAL PROSTATE  
Jane Jih, Chung Lee, Ph.D., Lynn Janulis, Ph.D.
- 9:45 - 10:00 CLONING AND CHARACTERIZATION OF A NOVEL NLS RECEPTOR, IMPORTIN  $\alpha$  4, FROM *CAENORHABDITIS ELEGANS*  
Jason Chang, Kenneth G. Geles, Dr. Stephen Adam
- 10:10 - 10:25 NITRIC OXIDE STIMULATION BY S100B WILDTYPE AND MUTANT PROTEINS IN BV-2 AND ASTROCYTE CELLS  
Barat Samy, Dr. Linda Van Eldick, Dr. Tanya Petrova
- 10:35 - 10:50 REPRESENTING THE CHILD'S BEST INTEREST IN DIVORCE AND CUSTODY CASES  
Ramona Bhatia, Aaron H. Foss, Dr. Kathryn Karsh
- 11:00 - 11:15 IMPROVING ADVOCACY FOR ABUSED AND NEGLECTED CHILDREN: CASA EVALUATION  
Irene Czajkowski, Samantha Mulvany, Kathryn Karsh, Ed.D.

**A-117**

- 8:30 - 8:45 RAMAN ANALYSIS OF MOTOROLA MACHINED SILICON  
Kenneth Tong, Yury Gogotsi
- 8:55 - 9:10 AGENT-BASED MODELING OF ANCIENT PERUVIAN COASTLINE VILLAGES  
Alan Liu, Jonathan Haas
- 9:20 - 9:35 REFERENCE INTERVALS FOR DELNOR-COMMUNITY HOSPITAL  
Jonathan Berger, Dr. James Pritchard, Dr. Lawrence Bartusek, Beverly Belli, Babette Thomas
- 9:45 - 10:00 CYTOPLASMIC MOTORS IN KARTAGENER SYNDROME FIBROBLASTS  
Rena Patel, Eduardo Pina, Dr. Robert J. Walter
- 10:10 - 10:25 DEVELOPING AN ALGORITHM FOR TRANSITION GAITS: CHANGING FROM ONE WAVE GAIT TO ANOTHER  
Jay Mowli, Kenneth Tong, Dr. Shin-Min S. Song
- 10:35 - 10:50 ANALYSIS OF THE MLL BREAKPOINT CLUSTER REGION TO IDENTIFY SEQUENCE POLYMORPHISMS  
Steven Andreoli, Loretta Li, Matthew Noesen, Janet D. Rowley, M.D., Nancy J. Zeleznik-Le, Ph.D., Deborah Echlin, Ph.D., Lydia Smith
- 11:00 - 11:15 END OF LIFE CARE FOR NEONATES  
Aparna Puppala, Denise Angst, DNSc.

**A-119**

- 9:20 - 10:00 MILITARY REVEILLE AND RETREAT CEREMONIES TRAINING VIDEO  
Melissa Huffington, Korina Pacyniak, Pearl Phaovisaid, Kenyatta Ruffin, James Bondi

**A-121**

- 8:30 - 8:45 THE VAST, MAGNIFICENT CHRISTIAN WORLD; OR, THE EXPERIENCES OF A GERMAN JEWISH WOMAN IN NAZI BERLIN  
Margaret Anderson, John Stark
- 8:55 - 9:10 STUDIES IN WRITING FICTION  
Tim Burns, Dr. Riva Kuhl
- 9:20 - 9:35 BEAUTY OF YELLOWSTONE: A JOURNEY OF PHOTOGRAPHS  
Denise Lorenz, Clay Sewell, John Thompson
- 9:45 - 10:00 EXPLORATION IN ART, FOCUS OF IMPRESSIONISM  
Julie May, Clay Sewell
- 10:35 - 10:50 INSIDE THE CRIMINAL MIND: A STATISTICAL ANALYSIS OF CRIME IN THE UNITED STATES  
Amanda Muller, Dr. John Sippy
- 11:00 - 11:15 THE PROCESS OF HYPNOSIS  
Henry Chu, Roman Ohler, Dr. John Sippy

**A-131**

- 8:30 - 8:45 CALIBRATION OF FORCE BALANCE WITH TURBOMIN TN75 TURBOJET ENGINE  
Carl Pickerill, Dr. David Williams
- 8:55 - 9:10 THE EFFECTS OF STRESS ON SALIVARY CORTISOL LEVELS IN HUMANS  
Megan Kiolbasa, Kathryn Murray, Dr. Harriet DeWit
- 9:20 - 9:35 SNELL'S LAW AND ITS RELATION TO LIFE  
Douglas Heintz, Dr. John Eggebrecht
- 9:45 - 10:00 PEDIATRIC AIDS: HIV-1 VIRAL BURDEN, CD4/CD8 COUNTS, AND THE ROLE OF VPR IN DISEASE PROGRESSION  
Jennifer Leung, Jill Starzyk; Yuqi Zhao, Ph.D.
- 10:10 - 10:25 RITA AND EUNICE ROCK THE WORLD: PART ONE  
SUPPRESSION OF HIV-1 BY CD8+ T-CELLS IN PEDIATRIC PATIENTS  
Eunice Lee, Rita Wang, William Kabat
- 10:35 - 10:50 VISUALIZATION OF THE PROTEIN CD40L USING IMMUNOHISTOCHEMISTRY  
Vikram Attaluri, Dr. Paul R. Scholl
- 11:00 - 11:15 LEXICAL STEGANOGRAPHY - HIDING INFORMATION IN TEXT  
Keith Winstein, Ronald H. Pine

**A-135**

- 8:30 - 8:45 ΚΑΦΕΝΕΙΟ ΣΤΟ ΣΧΟΛΕΙΟ (TRANSLATION: CAFÉ AT SCHOOL)  
Danielle Chandler, Micah Dortch, Louis Kazaglis, Ezra Lyon, Aristomenis Pikais, Anastasia Xinos, Nick Eliopoulos
- 8:55 - 9:10 DETERMINING THE REST MASS OF THE CHARGED K-MESON  
Daniel Mellis, Daniel Kaplan
- 9:20 - 9:35 APPLYING SCIENCE TO SOCIETY  
Andrew Moth, Dr. Lawrence Votta
- 9:45 - 10:00 DEVELOPMENT OF A PVDF FILM SENSOR FOR INFRASTRUCTURE MONITORING  
Clara Shih, M.L. Wang, D. Satpathi
- 10:35 - 10:50 HOW CAN IMSA STUDENTS DEVELOP AND IMPLIMENT CURRICULUM TO SPARK INTEREST IN HANDS ON SCIENCE LEARNING IN GRADES 3-5?  
Nicole Brown, Sylvie Chau, Carrie Giordano, Donielle Newell, Jennifer Vanichsombat, Britta McKenna
- 11:00 - 11:15 HIV ELIMINATION THROUGH VACCINE DEVELOPMENT  
James Carney, Dr. Liang Qiao

**A-147**

- 8:30 - 8:45      PIG TO HUMAN XENOTRANSPLANTATION (HOW THE UNLIKELY HERO WILL SAVE MANKIND)  
David Nopachai, Stephanie Wu, Dr. Byron Anderson, Winnie Pao, Clara Smith, Ethan Buckley
- 8:55 - 9:10      INVESTIGATION OF HOW MUTATIONS IN LARGE T-ANTIGEN AFFECT SV40 GROWTH  
Melvy Mathew, Gihoon Sung
- 9:20 - 9:35      THE EFFECTS OF VITAMIN D ON BRAIN MICROGLIA  
Andrea Ronkowski, Dr. Rita Young, Dr. Margaret Prechel
- 9:45 - 10:00     PROTEIN PHOSPHATASE-2A AFFECTS TUMOR CELL METASTASIS  
Adam Rojan, Dr. M. Rita Young, Jeremy Meisinger
- 10:10 - 10:25    HOW WAS VISUAL SURREALISM AFFECTED BY FREUD, GENDER ISSUES, AND TECHNOLOGY?  
Jennifer Schneidman, Dr. Robert Kiely
- 10:35 - 10:50    DETERMINING SIZE, SPEED, AND MASS OF THREE NEW THEROPODS  
Jonathan Frederick, Stephanie Hasselbacher
- 11:00 - 11:15    JAPANESE ADOLESCENTS: COMPARING THEM TO US  
Vanessa Clark, Tibeca Rodriguez, Jonathan Besancon

**A-148**

- 8:30 - 8:45      SERIATION AND CHRONOLOGY OF FIVE PUEBLO SITES IN THE NORTHERN RIO GRANDE AREA OF NEW MEXICO  
Aaron Wenzel, Dr. Jonathan Haas
- 8:55 - 9:10      THE EFFECTS OF SMOKING ON PRIMARY CESAREAN SECTION RATES  
Matthew T. Baumgart, Joseph R. Baumgart, M.D., Joseph Traina
- 9:20 - 9:35      PEARL DIVING IN THE PERSIAN GULF  
Derek E. Haas, Dr. Bennet Bronson
- 9:45 - 10:00     THE EFFECTS OF THE ENTERTAINMENT INDUSTRY AND MAINSTREAM MEDIA UPON AMERICAN MORALITY AND CULTURE  
Mirjana Jankov, Marie Haugh
- 10:10 - 10:25    COMPREHENSIVE STUDY OF *CASTOR CANADENSIS* AND ITS HISTORICAL AND ECONOMIC IMPLICATIONS  
Erikka Conrad, Jennifer Creamer, John T. Thompson
- 10:35 - 11:15    AN INTELLIGENT MOBILE PLATFORM: AN EXPLORATION INTO ROBOTICS  
Eliot Gable, David Johnson, Kartik Lamba, Glenn Tournier

**A-149**

- 8:30 - 8:45      NAFTA: THEN AND NOW  
Andrew Hoesley, Fred L. Fleischbein
- 8:55 - 9:10      PEPSI: SATISFYING THE CONSUMER-ADVERTISING IN JAPAN  
Loretta Kelly, Fred L. Fleischbein
- 9:20 - 9:35      QUALITY AND VALUE IN THE MARKETPLACE  
Kevin White, Fred L. Fleischbein
- 9:45 - 10:00     STUDY OF THE HMR INDUSTRY  
Ja-Lynn Kuo, Fred L. Fleischbein
- 10:10 - 10:25    USING SILICON DETECTORS FOR HIGGS BOSON SEARCHES AT CDF  
Alexandra E. Basak, Dr. Joseph Incandela, Dr. Joel Goldstein
- 10:35 - 10:50    THE INTERNET AS A DEVICE FOR TEACHING AND LEARNING  
Christopher Tessone, Laura Mengel
- 11:00 - 11:15    HISTORY OF THE PLANCK RADIATION LAW  
Matthew T. Baumgart, Andrew Price, Kevin Yao

## A-150

- 8:30 - 8:45 TRANSMISSION ELECTRON MICROSCOPY: THE ROUTE TO AN ATOMIC SCALE UNDERSTANDING OF ELECTRONIC MATERIALS AND DEVICES  
Sejal Patel, Nigel D. Browning, Ph.D.
- 8:55 - 9:10 SYNTHESIS OF 8-OXO-2'-DEOXYADENOSINE, LABALED, FOR USE IN CANCER RESEARCH  
Eric M. Bunnelle, Stephen A. Trevick, Dr. Richard van Breeman
- 9:20 - 9:40 A STATISTICAL ANALYSIS OF THE CHARMED MESON DECAY AND ITS RELATIVISTIC EFFECTS  
Erica McEvoy, T. Jordan
- 9:45 - 10:00 PROBING THE BIRTH OF THE SOLAR SYSTEM  
Rebecca Elsenheimer, Lawrence Grossman, Steven Simon
- 10:10 - 10:25 THE BUILDING OF A RADIO ALARM CLOCK  
Erich Elsen, Michael Olson, Rachel Bithell

## A-151

- 8:30 - 8:45 SURFACE TENSION AND NITROGEN FLOW RATE ANALYSIS IN SOLDER JET TECHNOLOGY USING ISOPROPYL ALCOHOL  
Ethan Wozniak, Dr. Megaridis, Eric Howell
- 8:55 - 9:10 STIQUITO AND LABVIEW: ADVANCED EXPERIMENTS WITH A SIMPLE ROBOT  
Jessica McAlear, Simone Washington, Dr. Richard L. Magin
- 9:20 - 9:35 MECHANICAL STRUCTURES IN FLUID SYSTEMS  
James Ethington, Marina Sivilay, Brianno Coller, Ph.D.
- 9:45 - 10:00 CONSTRUCTION OF SILICON CARBIDE MICROPIPES: ANALYSIS  
Terry Koo, Professor Yury Gogotsi, Michael Gardner
- 10:10 - 10:25 IMMUNOCYTOCHEMISTRY  
Anuoluwa Adeboje, Dr. Thackery Gray
- 10:35 - 10:50 INFLUENCE OF MICROGRAVITY ENVIRONMENT ON ISOLATED FUEL DROPLETS, WITH RESPECT TO FLAME CHARACTERISTICS AND SOOT PRODUCTION  
Sarah Ashraf, Brian Kambach, Dr. Mun Young Choi
- 11:00 - 11:15 PROPERTIES OF COMBUSTION AND FLAME STRUCTURES  
Matthew Cohen, Andrea Llenos, Dr. Ishwar K. Puri, Stefano Ratti, Chun W. Choi

## A-152

- 8:30 - 8:45 SEROTONIN RECEPTORS  
Sunita Jasti, Dr. Thackery Gray, Adil Javed
- 8:55 - 9:10 LACK OF CORRELATION OF CALCINEURIN PROTEIN LEVELS AND ENZYME ACTIVITY IN AD BRAINS  
Steven Baker, Dr. John M. Lee
- 9:20 - 9:35 RECURRENCE QUANTIFICATION ANALYSIS OF THREE-DIMENSIONAL PROTEIN STRUCTURES  
Saugar Maripuri, C. L. Webber Jr.
- 9:45 - 10:00 AN INDUSTRIAL WEB PAGE: HOW CAN WE MAKE IT MORE USEFUL?  
Scott Harrison Cutler, John Jurek
- 10:10 - 10:25 FERMILAB PHYSICS EXHIBITS ON THE WORLD WIDE WEB  
Vishesh Narayen, Elizabeth Quigg
- 10:35 - 10:50 RUNNING REPORTS FROM ORACLE DATABASES FOR DISPLAY ON WWW PAGES  
Kevin Price, Ruth Pordes, Barbara Angelos, Shirley Jones, Stephen White
- 11:00 - 11:15 AUSCHWITZ MEDICINE: DR. ERNST B. & DR. JOSEF MENGELE  
Jessica L. Yokley, Janet Akcakal

**A-155**

- 8:30 - 8:45 THE EFFECT OF GENDER AND PAIRING ON NEONATAL OUTCOMES IN CONCORDANT TWINS  
Venkata Narla, Anjali Vijayakumar, Dr. Jonathan K. Muraskas, Dr. Debra Guinn,
- 8:55 - 9:10 DETECTION OF BETA 2 ADRENERGIC RECEPTOR EXPRESSION IN FOUR GENERATIONS OF CD4+ TH1 AND TH2 EFFECTOR CELLS DERIVED FROM CD4+ NAIVE T CELLS  
Nicholas P. Morley, Virginia M. Sanders, Ph.D., Adam P. Kohm, Michelle A. Swanson
- 9:20 - 9:35 ANALYSIS OF THE SIMIAN VIRUS 40 GENOME IN HUMAN MESOTHELIAL CELLS  
Adrianna Zhang, Dr. Michele Carbone
- 9:45 - 10:00 THE EFFECT OF ADP RECEPTOR INHIBITORS ON HEPARIN ANTIBODY INDUCED PLATELET ACTIVATION  
Sylvie Chau, Dr. Jeanine M. Walenga, Walter P. Jeske, Ph.D., Jennifer J. Wood, Shazia Zaman
- 10:10 - 10:25 THE EFFECTS OF TESTOSTERONE ON NITRIC OXIDE SYNTHASE EXPRESSION IN ADULT LABORATORY RAT BRAINS  
Dan Murariu, Robert Handa, Ph.D
- 10:35 - 10:50 MONITORING OF THE ANTI-PLATELET EFFECTS OF NEW DRUGS FOR THE MANAGEMENT OF ACUTE MYOCARDIAL INFARCTION  
Mita B. Patel, Peng Wu, Dr. Jawed Fareed, Dr. Debra Hoppensteadt-Moorman
- 11:00 - 11:15 A COMPARATIVE STUDY OF CYTOKINES INVOLVED IN B LYMPHOPOIESIS IN AGED AND YOUNG MICE  
Abidemi Adeboje, Pamela L. Witte

**B-145**

- 8:55 - 9:10 HOLOGRAPHY: EXPLORATIONS OF THE FLAT THREE-DIMENSIONAL WORLD  
Riley Aumiller, Jonathon Helm, Dave Johnson, Linus Wong, Raymond Yee, Dennis Federico, Michael Lindenmeyer



## **A COMPARATIVE STUDY OF CYTOKINES INVOLVED IN B LYMPHOPOIESIS IN AGED AND YOUNG MICE**

### Presenter:

Abidemi Adeboje, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506 USA; 630-907-5231; abidemi@imsa.edu

### Mentor:

Pamela L. Witte, Department of Cell Biology, Neurobiology and Anatomy, Loyola University Chicago, Maywood, IL 60513 USA; 708-216-3358

B-lymphopoiesis is regulated by a number of cytokines/growth factors produced in the bone marrow. The primary growth factor is IL-7, and is enhanced by a number of additional cytokines, such as IGF-1 and stem cell factor. B-lymphopoiesis has been shown to decline with age, marked by a significant decrease in the pre-B cell population. This laboratory has previously shown that the production/secretion of IL-7 decreases with age, although changes in other growth factors have not yet been examined. In contrast to the decline in pre-B cells, the most differentiated of B-cells, the plasma cell, increases in frequency in the bone marrow. This has led to our hypothesis that some aspect of the marrow microenvironment changes during aging to promote skewing in the balance of pre-B and plasma cells. The key may be age-related differences in the production of growth factors by the marrow microenvironment. We have used the polymerase chain reaction (PCR) to screen for changes in growth factors. Specifically we have looked at cytokines, which augment IL-7, namely, IGF-1 and stem cell factor, as well as cytokines, which stimulate plasma cells, such as IL-6. Comparisons were made between old mice and their young counterparts.

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## **IMMUNOCYTOCHEMISTRY**

### Presenter:

Anuoluwa Adeboje, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; 630-907-5144; tope@imsa.edu

### Mentor:

Dr. Thackery Gray, Professor Department of Cell Biology, Neurobiology and Anatomy at Loyola University Maywood, Illinois 60153; 708-216-3345; tgray@bsd.medctr.luc.edu

Immunocytochemistry is a technique employed to identify the location of proteins in biological tissue. Antibodies are produced by immunizing an animal to a specific protein. The antibodies are collected and are used to find the same protein in other animals. The location of specific proteins are mapped on tissue samples mounted on slides and examined by using a microscope. Immunocytochemistry is commonly applied in clinical and research analysis of diseases. Research projects using this method of analysis are very widespread. For example, the technique is used to find important communicating chemicals and receptors in the brain, spinal cord, and other areas of the body. In the Department of Cell Biology, Neurobiology and Anatomy at Loyola University the location of serotonin receptors in rat brains is being mapped using this procedure. Serotonin is a communicating chemical that is released by nerve cells in the brain. It is important for normal brain functioning and is probably disturbed in the brains of humans that have depression, panic disorder and other anxiety related psychiatric diseases. The immunocytochemical procedure and how it is applied for identifying the location of serotonin receptors in rat brain will be presented.

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## BIOGRAPHIES OF TWENTIETH CENTURY SCIENTISTS

### Presenters:

Stephanie Allewalt, Batavia High School, 1200 W. Wilson Street, Batavia IL 60510  
Margaret Anderson, Illinois Mathematics and Science Academy, 1500 W. Sullivan, Aurora, IL 60506  
Blaine Eubanks, Illinois Mathematics and Science Academy, 1500 W. Sullivan Rd, Aurora, IL 60506  
Elizabeth Gilbert, Illinois Mathematics and Science Academy, 1500 W. Sullivan Rd, Aurora, IL 60506  
Douglas Heintz, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
Susan Johnson, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
Noah Lauricella, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
Nicki Pieart, West Aurora High School, 1201 W. New York Street, Aurora, IL 60506  
Erica Ruddy, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
John Velazquez, East Aurora High School, 500 Tomcat Lane, Aurora, IL 60505  
Margaret Wat, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
Maria Wilson, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
Grace Yang, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Advisors:

Dr. Neill Clark, English faculty, Illinois Mathematics and Science Academy, Aurora, IL 60506  
Dr. Leon Lederman, Great Minds Program, Illinois Mathematics and Science Academy, Aurora, IL 60506  
Dr. Judith Scheppler, Coordinator of Student Inquiry, Illinois Mathematics and Science Academy, Aurora, IL  
Dr. Gregg Sinner, Principal/Director of Student Inquiry, Illinois Mathematics and Science Academy, Aurora, IL

Our goal is to compose a book about the lives and accomplishments of famous living scientists. We will target the book toward middle and high school students, to cultivate their scientific interests. Each team member chose a specific area of science that they are interested in, and then they selected a twentieth century scientist to interview and study. Each team member will write a chapter about the scientist they chose. As a group we have been studying how books are written, explored the process of interviewing, and formulated good interview questions. We have also written a book prospectus that is being sent to publishers to examine marketing possibilities for our book. We plan to have a final product completed before the completion of next school year. The project team includes members from Batavia High School, East Aurora High School, and West Aurora High School.

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## **THE VAST, MAGNIFICENT CHRISTIAN WORLD; OR, THE EXPERIENCES OF A GERMAN JEWISH WOMAN IN NAZI BERLIN (DIE WEITE, HERRLICHE CHRISTLICHE WELT; ODER, DIE ERLEBNISSE EINER DEUTSCHEN JÜDISCHEN FRAU IM BERLIN DER NAZIS)**

### Presenter:

Margaret Anderson, Illinois Mathematics and Science Academy, Aurora, IL 60506 USA; 630-907-5355;  
manders@imsa.edu

### Advisor:

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The first fifty years of the twentieth century were some of the most violent and turbulent in Europe throughout the past two millenia. In few nations was this more true than in Germany. How did German Jews reconcile their identity with the politics of the Nazi Party? What was the experience of young Germans during the Weimar Republic? "Du bist nicht so wie andere Mütter" (You're Not Like Other Mothers) is the story of Else Kirschner, a woman born to a Jewish family in Berlin in 1893. This biographical account written in German by Else's daughter tells about the life of her mother, whose adult experiences span the epoch from the Treaty of Versailles through the bombing of Hiroshima. An extraordinary woman, who lived through an unimaginable era, her story gives us insights into the minds and lives of the citizens of that world. My presentation will analyze the questions of place and identity, which arise in the course of this story. *(This presentation will be given in German.)*

## **ANALYSIS OF THE MLL BREAKPOINT CLUSTER REGION TO IDENTIFY SEQUENCE POLYMORPHISMS**

### Presenters:

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The *MLL* gene, located on chromosome band 11q23, is involved in chromosomal translocations that result in acute myeloid leukemia (AML) and acute lymphoid leukemia (ALL). Most of the *MLL* translocation breakpoints occur within an 8.3 kb region known as the breakpoint cluster region (BCR). Therapy-related leukemia (t-AML) develops in 1% to 15% of patients treated with DNA topoisomerase II (topo II)-targeting drugs. Whether these t-AML patients are randomly adversely affected by the chemotherapeutic regimen or whether they have an unusual susceptibility to topo II inhibitors is unknown. Genetic polymorphism within the *MLL* BCR could be an explanation for this observed susceptibility. In our studies, all patients examined were previously treated with some type of topo II-targeting drug for their primary malignancy. PCR amplification of patient genomic DNA, automated DNA cycle sequencing, and computer analysis of patient sequences were utilized to examine the *MLL* BCR in each sample. If consistent DNA changes that correlate with the propensity for developing t-AML are identified, patients could be screened for the presence of this polymorphism prior to chemotherapy. If the polymorphism exists in the patient, a different chemotherapeutic regimen that doesn't include topo II-targeting drugs would be utilized, perhaps diminishing the incidence of therapy-related AML.

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## **INFLUENCE OF MICROGRAVITY ENVIRONMENT ON ISOLATED FUEL DROPLETS, WITH RESPECT TO FLAME CHARACTERISTICS AND SOOT PRODUCTION**

### Presenters:

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In the developing space frontier, safety is an ever-important concern. With recent incidents on Mir and the upcoming development of the International Space Station, understanding how fires burn and propagate in a

reduced gravity environment is very essential to ensuring the safety of the astronauts. In order to understand how a fire burns as a whole, it is necessary to understand how the individual droplets burn. Our project was an analysis of the differences caused by burning fuel in a reduced gravity environment compared to normal gravity, and differences caused by adding an oxidant, ferrocene, to the fuel mixture. There are many research facilities that have reduced gravity capability, but it is very inconvenient to travel to these facilities to test an experiment and find out that it does not work properly. We created our own mini-drop tower, which allowed a simulation of .05 g for approximately .7 seconds, to facilitate testing our experiments. The mini-drop tower offers additional testing capability at minimal cost.

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## **VISUALIZATION OF THE PROTEIN CD40L USING IMMUNOHISTOCHEMISTRY**

### Presenter:

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### Mentor:

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CD40 ligand (CD40L), a 33-kDa type II membrane glycoprotein, is expressed primarily on the surface of activated CD4<sup>+</sup> T lymphocytes and is vital in the immune system response. It is required to interact with the CD40 on the surface of B lymphocytes. The protein, like other tumor necrosis factor family members, has been found to exist in a trimer state on the surface of T cells. Mutations in the gene encoding CD40L, which alter its expression on the surface of activated T cells, are associated with a severe immunodeficiency disease in man, X-linked Hyper-IgM syndrome (XHIM). The mechanisms by which CD40L trimers are created and transported to the surface of the cell have not been characterized in detail. To enable this issue to be addressed, a lab protocol that allows immunohistochemical detection of CD40L with little background staining has been developed. The protocol has been used successfully to demonstrate cytoplasmic CD40L protein in a human T-cell line and in fibroblasts transfected with the human CD40L DNA. This protocol should be useful in future studies of CD40L protein expression.

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## **HOLOGRAPHY: EXPLORATIONS OF THE FLAT THREE-DIMENSIONAL WORLD**

### Presenters:

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In order to create holograms, a proper environment must be created. That environment must have minimal exposure to light as well as no vibration. We started our project by constructing a vibration isolation table. After

this time intensive project, we tested our table using two methods. First, by using an interferometer we were able to determine that the interference patterns created by the diffraction remained in their original orientation. Our second test was the creation of the simplest kind of hologram, a transmission hologram. With a positive result from the first tests of our table, we then created a white-light hologram, the kind of hologram that can be viewed without special equipment. At this point, we then considered the possibility of original research in the field of holography. Our research led us to creating a project in which we used interferometry, a well-known application of holography, to recalculate G. Unfortunately, after two months of research, we discovered two factors that inhibited us from completing our chosen project. First, we were unable to complete the extensive trials required to complete our project. Second, IMSA did not have the precision equipment required for the research. As a result, we have spent the last few available working days perfecting our existing techniques.

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## **LACK OF CORRELATION OF CALCINEURIN PROTEIN LEVELS AND ENZYME ACTIVITY IN AD BRAINS**

### Presenter:

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### Mentor:

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In the United States, Alzheimer's disease (AD) is present in 5% to 15% of people over the age of 65. The major histopathological hallmarks of AD are the early development of senile plaques composed of A $\beta$  1-40 (42) and later the appearance of neurofibrillary tangles composed of hyperphosphorylated tau protein. Previously, Ladner et. al. (J. Neuropath. and Exp. Neurol. 55:924, 1996) demonstrated a decrease in the activity of protein phosphatase 2B (calcineurin) in AD. Within individual cases, this enzyme activity correlated inversely with the presence of neurofibrillary tangles suggesting a role for decreased calcineurin activity in tangle formation. One possible mechanism for the lowered calcineurin activity could be a decrease in calcineurin protein expression. To test this hypothesis, Western blots of calcineurin subunits A and B protein expression were conducted on AD (n=6) and control (n=6) P2 and whole cell brain homogenates from the superior frontal cortex (Brodmann areas 8,9,24). Quantification of the individual protein bands by NIH image analysis system (v1.61) indicated that the protein expression levels of the both the A or B subunits were not different between AD and age-match control samples (p >0.05). These data suggest that the decrease in calcineurin activity in AD brains is not due to a lowered protein expression of the native enzyme but could be due to alterations of other modulatory proteins which interact with calcineurin (e.g. calmodulin, AKAP79 scaffolding protein).

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## **GENERAL DEVELOPMENT NETWORK**

### Presenters:

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An experimental network utilizing available resources was constructed in 1505 A25 and 26. The setup was created to show that outdated, inexpensive computers can be used in the place of current systems in fulfilling basic educational and business needs. At present, the network provides basic services including e-mail, web access, web hosting, programming ability, and word processing. Future projects include universal authentication, and shared user file space. Uses of this network will be discussed, as well as methods of implementation.

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## **USING SILICON DETECTORS FOR HIGGS BOSON SEARCHES AT CDF**

Presenter:

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Mentors:

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During the past decade, high-energy particle physics has ascertained the identity of constituents of matter smaller than the atom, including quarks and leptons, and classified these particles into a scheme termed "The Standard Model". The Higgs Boson, a particle predicted by "The Standard Model", but not yet observed, will be sought in the CDF Run II in proton-antiproton collisions. The intent of this mentorship was to perform optimization studies for the Run II silicon detector design. Evaluations of the silicon detector data collected in the previous detector run are assessed by means of the Physics Analysis Workstation (PAW++) software package. With this program, it is possible to analyze the relationship between the resolution, charge, cluster size, and pitch (the distance between successive silicon strips) from the previous run of the Tevatron. Knowing the trend for resolution as a function of charge, for example, will be crucial information for the optimal design of the upgraded detector set to debut in April of 2000.

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## **HISTORY OF THE PLANCK RADIATION LAW**

Presenters:

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Planck's formula for blackbody radiation is generally regarded as the beginning of quantum mechanics. Such an event raises historical questions about its discovery. Through reading the primary historical experts on the subject, our hope is to understand Planck's formula and how he derived it, determine the influence of Boltzmann on Planck, and how Planck's research into entropy and the Second Law of Thermodynamics necessitated a radiation distribution law. Furthermore, even after the publication of his law in 1900 and 1901, it would not be until 1908 that multiple physicists began to recognize the theory's incompatibility with classical physics. We hope to provide an explanation for this delay, how Planck first accounted for the discrete energy values present in

his theory, what eventually caused scientists to discover something was amiss, and how they arrived at the theory of the quanta from his equation.

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## THE EFFECTS OF SMOKING ON PRIMARY CESAREAN SECTION RATES

### Presenters:

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**Objective:** To determine if smoking significantly affects the primary cesarean section rate either on its own or when coupled with other social or anthropometric factors, and to study smoking's effects on the various indications for primary cesarean section. **Methods:** A retrospective study was performed using data from 1132 consecutive deliveries of 929 patients from a single physician practice (JB). Data were sorted according to maternal smoking status, fetal sex, birth weight, maternal weight, maternal height, maternal age, pay type, parity, and indication. Two and three-dimensional chi-square tests were performed to determine variables that were significant for primary cesarean section rates. **Results:** The rate of smokers' primary cesarean sections (10.98%) was greater than that of non-smokers (9.82%). This relationship was not found to be statistically significant [ $p=0.581$ ]. The primary cesarean section rate was found to be statistically dependent on smoking when coupled with birth weight [ $p$  less than 0.01]. Among the variables that were tested alone, birth weight was found to have a statistically significant influence on primary cesarean section rates [0.00008], as was the age for nulliparous women [ $p=0.005$ ]. For the four classes of indications, fetal Distress, dystocia, malpresentation, and miscellaneous were all found to not have statistical significance with smoking. The tests with parity showed it to have a statistically significant influence on birth weight [ $p=0.025$ ]. **Conclusion:** The fact that smoking did not significantly influence primary cesarean section rates on its own is further supported by the fact that except for birth weight, and age of nulliparous women, no category was statistically

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## REFERENCE INTERVALS FOR DELNOR-COMMUNITY HOSPITAL

### Presenter:

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### Mentors:

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Babette Thomas, Laboratory Information System Coordinator, Delnor-Community Hospital

The purpose of this experiment was to find the normal reference values for the Delnor-Community Hospital (DCH) population. It is important for a hospital laboratory to have current and accurate normal intervals because they can assist a doctor in making a diagnosis. In this project, data was collected from two sources; DCH outpatients and sixty healthy individuals gathered from the adjacent health center. It was found that intervals calculated from outpatients produced a range too wide to be considered useful for the diagnosis of health. At one time in medicine, outpatients were considered healthy people. This assumption can no longer be made. There are many people who may have an illness, yet reside outside of a hospital. The ranges based on results from health center members were similar to the accepted published values. Possible explanations for the difference between health center members and outpatients will be discussed, as well as an analysis of various individual chemistry tests and their meaning.

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## **REPRESENTING THE CHILD'S BEST INTEREST IN DIVORCE AND CUSTODY CASES**

### Presenters:

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### Mentor

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Children whose parents are involved in divorce/custody cases are at risk for a number of physical, psychological, and emotional problems. The focus of this research was how to most effectively represent the best interest of the child in court proceedings. In the past, Court Appointed Special Advocates (CASAs), Guardian ad Litem, private attorneys and therapists have been successfully employed in some cases. Research was conducted with the purpose of gaining input from judges, attorneys, therapists, and other related parties. Interviews as well as written surveys were distributed to pertinent forums, so as to ensure a wide spectrum of viewpoints and consequently a more informed conclusion. The data collected was then pooled and analyzed for significance. A conclusion was drawn from the data obtained and a final report was produced.

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## **THE EFFECTS OF HYPOXIA ON THE FREQUENCY OF GASP-LIKE RHYTHM GENERATION IN MICE**

### Presenter:

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Three respiratory motor patterns seem to be generated within the ventrolateral medulla in the mammalian brainstem: eupnic breathing ('normal' breathing) which normally occurs during normoxia; gasping which is characterized by decrementing activation of the phrenic nerve discharge and normally occurs during and after hypoxia (St. John, 1998); and augmented breaths, or sighs, which are usually triggered by normal eupnic inspiration. In my experiments, I have aimed to characterize the respiratory rhythmic activities in the *in vitro* isolated respiratory network of mice. For my presentation, I will discuss the frequency of gasp-like rhythmic activity before and after the induction of hypoxia. I will also further discuss the implications of these findings including (a) the exact location of the different neuronal networks, (b) the mechanisms that underlie the generation of these three motor patterns and (c) the mechanisms that are responsible for the interaction between these networks.

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## **NON-EVASIVE DEFECTION VIA EXTRALUMINAL VIBRO-ACOUSTIC PROPERTIES**

### Presenter:

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### Mentor:

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MRI's and other expensive and time-consuming techniques are all that is currently available for diagnosis of gastrointestinal perforation. The objective of this research is to develop a technique for the immediate, painless,



safe, and low-cost diagnosis of such a condition. The central hypothesis is that the abdomen has low frequency vibro-acoustic properties that are relative to the extraluminal air and are measurable. Therefore, if known excitations are applied to the abdominal region of patients, responses should be different and detectable by a vibro-acoustic sensor (i.e. "electronic stethoscope"). This project is designed to 1) develop theoretical and computational models to guide design optimization of the proposed diagnostic technique; 2) develop and test experimental mechanical models consisting of different gas, liquid and solid media in varying elastic enclosures which approximate abdominal content; and 3) demonstrate the feasibility and accuracy of these diagnostic methods in both experimental animals and humans.

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## **HOW CAN IMSA STUDENTS DEVELOP AND IMPLIMENT CURRICULUM TO SPARK INTEREST IN HANDS ON SCIENCE LEARNING IN GRADES 3-5?**

### Presenters:

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IMSA students participating in this Inquiry designed the curriculum for a summer science day camp. The goal of Science Explorers is to spark the interest in science and technology of Chicagoland area third through fifth graders. The IMSA student teachers chose ten topics and curriculum was designed around these topics. They include: Yucky States of Matter, Water World, Toy Science, Food Science, Inventor's Day, Detective Science, Light and Color, Animalia, Outer Spaced-Out and Tour of the Human Body. Professionals in the ten fields were solicited to serve as Resident Scientists during the summer camp. An "On the Road" program was created to take one of the ten topics to area schools. "Inventors and Inventions," a two hour presentation, was well received at 5 Chicagoland elementary schools (Winfield, Schieser, St. Michael, McCleery and Prairie) in February and March. A third aspect of Science Explorers was our "Field Trips" designed so that the IMSA students who would be teaching at the summer camp could test two hours of their summer curriculum. Five Field Trips will take place in April and May. The finalized curriculum will be used in the summer day camp June 14-18 and June 21-25.

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## **SYNTHESIS OF 8-OXO-2'-DEOXYADENOSINE, LABALED, FOR USE IN CANCER RESEARCH**

### Presenters:

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This project concerns the modification of a gram-scale reaction to a milligram scale for the synthesis of stable isotope-labeled 8-oxo-2'-deoxyadenosine. The <sup>15</sup>N and <sup>13</sup>C-labeled product will be used as an internal standard during a liquid chromatography-tandem mass spectroscopy assay of DNA oxidation products. Beginning with 2'-deoxyadenosine, 8-bromo-2'-deoxyadenosine was initially formed followed by nucleophilic substitution and then hydrogenation to yield the desired product. Electrospray mass spectroscopy and HPLC with UV absorbency were used to analyze the yield and purity of the reaction products.

## STUDIES IN WRITING FICTION

### Presenter:

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I am writing a novel to understand language. I began with a few simple fantasies. They were dreams of one kind or another that had inextricably taken root in my daily thoughts. I connected one dream to another with words. I compared the resulting fantasy to yet another dream. As I connected further and further, I found that my words, though ~~thick in~~ their fantasies, actually traced a realistic image. My task, with writing, is to manipulate those fantasies in a way that reveals reality. This has often been difficult. After all, a realistic depiction of fantasy seems more like a problem than a solution. In a sense, I'm using dreams to understand life. My discussion will focus on the roadblocks and catalysts of writing, in addition to my specific encounters thus far with my novel.

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## HIV ELIMINATION THROUGH VACCINE DEVELOPMENT

### Presenter:

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This project's purpose was to develop a vaccine that activates HIV-specific mucosal/systemic CTL, using HPV-like particles as a vector. HIV infects vaginal/gut CD4+ cells during initial transmission, which may also serve as a viral reservoir; thus, it is important to generate CTL to clear the virus. Since a mucosal immune response requires mucosal immunization and HPV16 is mucosa-tropic, it was hypothesized that HPV16 can serve as a vector for mucosal immunization. To test this, DNA encoding an HIV-HPV complex was separated from E. coli by centrifuging and lysing the cells. The separated DNA was then transfected into sf9 cells so that it could be replicated at a faster rate. After each week in a two-week period, the cells had been lysed, allowing for collection of the replicated DNA. During the third week, the cells were only transfected for three days, allowing the particles encoded by that DNA to be collected and used to immunize mice intranasally and intrarectally. When this is accomplished, mucosal cells of the mice will then be isolated, allowing for observation of the frequency of CTL specific for HIV. Although the HIV vaccine has not yet been determined, experimentation continues to provide the basis for its development.

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## ΚΑΦΕΝΕΙΟ ΣΤΟ ΣΧΟΛΕΙΟ (TRANSLATION: CAFÉ AT SCHOOL)

### Presenters:

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The Greek Study Group decided to explore the Greek heritage by studying the Greek language and culture. We focused on conversational skills by immersion into the language. Topics such as greetings, weather, key phrases, state of affairs, and other basic introductory conversations were covered. These are the types of language skills one might need if they traveled to Greece for the first time and met Greek-speaking individuals. An open, interactive simulation of a typical Greek café will be experienced. This will include Greek music, poetry, music, food, drink, visuals (scenes), and conversation for the audience to partake in. Expand your palate with the tastes of Greece. Join us at the café and experience the Greek culture for yourself!

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## CLONING AND CHARACTERIZATION OF A NOVEL NLS RECEPTOR, IMPORTIN $\alpha$ 4, FROM *CAENORHABDITIS ELEGANS*

### Presenter:

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One of the most important processes that a cell must regulate is that of nuclear transport. Nuclear transport refers to the transfer of molecules between the cytoplasm into the nucleus. The cell keeps its DNA separate from the cytoplasm by a nuclear envelope. The regulation of traffic through this barrier is achieved by the use of many specialized proteins known as nuclear transport factors. Two such factors are Importin  $\alpha$  and  $\beta$ . Importin  $\alpha$  binds to a nuclear localization sequence (NLS) on the target protein. Importin  $\beta$  then mediates the passage of this complex through a nuclear pore complex. Interestingly, there are three known families of Importin  $\alpha$ s. The reason for this is not understood, and thus the microscopic worm *Caenorhabditis elegans* (*C. elegans*) was chosen as a model of study because of its simplicity. Three classical Importin  $\alpha$ s have been identified in *C. elegans*. A fourth, novel Importin  $\alpha$ , IMA 4, was predicted by a protein database search. Polymerase Chain Reaction (PCR) was utilized to clone IMA 4 from *C. elegans*.

## **THE EFFECT OF ADP RECEPTOR INHIBITORS ON HEPARIN ANTIBODY INDUCED PLATELET ACTIVATION**

### Presenter:

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### Mentor:

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Heparin-induced thrombocytopenia (HIT) is a devastating disease, which stems from an allergic reaction to heparin (an anticoagulant frequently used in surgery). HIT is characterized by a platelet count  $< 50,000/\mu\text{l}$ . The antibodies generated in HIT patients can promote blood clotting by activating platelets, which often leads to amputation or death. Platelet activation can be measured *in vitro* by mixing HIT patient serum and platelets from a healthy volunteer with heparin. It has been shown in the mentor's laboratory that adding small amounts of ADP can sensitize the platelet response to HIT antibodies. These results and other knowledge led to the design of a study on the activation of platelet ADP receptors in HIT. Our purpose is to characterize the ADP response by studying the effect of compounds specific for various subtypes of the ADP receptor using the agonists 2-methylthio-5' ATP (2MT5ATP) and  $\beta,\gamma$ -methylene-ATP plus various ADP antagonists. To date, the data indicate that 2MT5ATP (P2y receptor sub-type) shortens the time to 50% aggregation but does not effect the maximum aggregation response, and the ADP degrading enzyme, apyrase, inhibits platelet aggregation. These data suggest that the P2y ADP receptor is important for platelet activation in HIT patients. Studies involving receptor specific antagonists are currently underway.

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## **COYOTE VOCALIZATIONS**

### Presenters:

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### Advisor:

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In January of 1999, we began studying animal bioacoustic patterns. Coyotes have the widest vocal range of any animal on Earth, making them an ideal candidate for the study. We are currently utilizing state of the art equipment to record coyote vocalizations in the field. We will use the Canary program, provided by Cornell University, to analyze the range and patterns of these vocalizations. Through this study we hope to obtain new and important knowledge.

## EVOLUTION OF THE HANNAFORD WOODS GREAT BLUE HERON ROOKERY

### Presenters:

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We have been studying the Hannaford Woods great blue heron rookery since the 1994-95 school year. Our studies have concentrated on the impact that a new housing development directly to the east of the rookery has had on nesting patterns. In the year of 1997, we extended our study to include the relevance of nest size and age to chick survival. For the first two years of our study, we found that the center of gravity of the rookery was moving away from the housing development; neither the number of nests nor the number of surviving chicks changed significantly. During the 1996-97 school year, our heron and nest counts declined drastically. The rookery was also damaged by severe windstorms, and we could not ascertain whether any chicks grew to maturity. Since then, the heron population has steadily declined. As of this year, there are no remaining substantial nests in the rookery. One pair of hawks and another pair of owls have taken up residency in the rookery, but we have not ascertained their relevance to the decline in heron population. We are continuing the study to determine whether the herons will return or migrate to a different area.

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## POPULATION STRUCTURE OF THE CAPTIVE NORTH AMERICAN MARKHOR (*CAPRA FALCONERI*) USING mtDNA SEQUENCING AND MICROSATELLITE LOCI

### Presenter:

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### Mentor:

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The subspecies of the present North American zoo markhor population must be known to establish a successful breeding program for Heptner's markhors (*Capra falconeri heptneri*). We are comparing mtDNA sequencing and microsatellite loci of various North American zoo populations to markhors in Assiniboine Park Zoo where the last descendents of the Munich line reside. We collected data with two markhors from Burnet Park Zoo, six markhors from Franklin Park Zoo and four markhors from Assiniboine Park Zoo. Three microsatellite loci screened showed no size variation. One microsatellite locus showed variability and will be tested on the entire panel. Taxonomic maps for both cytochrome b gene and control region (Dloop) sequencing showed that while the Franklin markhors grouped with other sequenced published markhors, the Burnet markhors grouped with a domestic goat and bezoar. Restriction fragment length polymorphism (RFLP) confirmed that the Burnet markhors may be hybrids. Since hybridization has been observed in the wild, it is not clear whether the Burnet line hybridization occurred in the wild or captivity. Further gene sequencing needs to be done for the Assiniboine markhors.

## **THE PROCESS OF HYPNOSIS**

### Presenters:

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R. Ohler, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506, USA;  
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### Advisor:

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Henry Chu and Roman Ohler conducted a research project involving how hypnosis works. Various media were examined including books, periodicals, and videocassettes. The parts of hypnosis were closely looked at including induction, post-hypnotic suggestion and the four states of consciousness (brain waves). For the most part, hypnosis by external control was looked at as opposed to self-induced hypnosis. All of these topics will be discussed during our presentation. We will also include a small video clip of a demonstration of hypnosis.

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## **JAPANESE ADOLESCENTS: COMPARING THEM TO US**

### Presenters:

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Many misconceptions surround the image of adolescents. Americans do not realize the affect of their culture on teens, and even less is understood about adolescents living in other regions. Also, many societies are still perceived as exotic or alien. In an endeavor to approach reality, objective knowledge is necessary to bridge the gap between American teenagers and their foreign counterparts, the adolescents of Japan. Focusing on relationships, technology, and recreational aspects of culture, a comparative study of teenagers reveals interesting information.

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## **PROPERTIES OF COMBUSTION AND FLAME STRUCTURES**

### Presenters:

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### Mentors:

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Stefano Ratti, Research Assistant, Department of Mechanical Engineering, University of Illinois-Chicago,  
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Professor Puri's research group at the UIC Reacting Flow Laboratory is investigating the structure of flames established with various fuels. Sets of data are being obtained in that laboratory for flame temperatures, heat

release profiles, holographic fringe patterns, flame frequencies, gas-phase concentrations, and other phenomena that occur as a consequence of combustion. The objective of these investigations is to develop physical and chemical models to accurately predict combustion behavior under various conditions. Our tasks involved data collection from various combustion experiments using a high speed video camera, a gas chromatograph, and laser interferometric holography. Our results are being compared with the model-generated data. A preliminary comparison of our data with the predictions revealed some discrepancies in the model, particularly how gravity affects the flames. It is relatively simple to turn off gravity in the model, but impossible during a real laboratory experiment. The ultimate goal of Professor Puri and our research is to run enough experiments to pinpoint the discrepancies in the model in order to design an experiment that can be performed in a microgravity environment, such as a drop tower or space shuttle. This will provide a real set of microgravity measurements to compare to the model-generated data.

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## **COMPREHENSIVE STUDY OF *CASTOR CANADENSIS* AND ITS HISTORICAL AND ECONOMIC IMPLICATIONS**

### Presenters:

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### Advisor:

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Beaver undercoats have long been an important economic commodity. The fur of the beaver is regarded as making the highest quality hat felt. Their use in the European hat industry sparked the influx of many fur trappers and traders into the northern United States and Canada between 1580 and 1840, when beavers were driven nearly to extinction. There is limited research in which the undercoat has been looked at in a scientific manner to determine what qualities make it so valuable as felt. Using bright field and electron microscopy, the beaver hairs were compared to several other types of hairs, such as rabbit and sheep, to determine what properties give it its unique felting ability. In order to collect and examine mercuric nitrate treated fibers, typical of the eighteenth century, a research proposal was submitted and approved by the Chicago Historical Society. The mercuric nitrate treated hair samples were compared to fibers treated with nitric acid, typical of the twentieth century. The results were then placed into an economic and historical context, to further the understanding of human beaver interactions.

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## **AN INDUSTRIAL WEB PAGE: HOW CAN WE MAKE IT MORE USEFUL?**

### Presenter:

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### Mentor:

John Jurek, Vice-President, Lakeside Equipment Corporation, Bartlett, Illinois, 60103, USA, 630-837-5640;  
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There are millions of web sites on the Internet, but few, if any, are actually useful to industry. Useful features are defined as features that allow any person trying to achieve a specific task to do it efficiently and completely. Throughout this project, at least a hundred web sites were analyzed. The useful features were taken into consideration and the useless features stood as an example of what not to do. Then each useful feature was incorporated into a new all-encompassing web page that was designed to catch the user's attention and allow that user to accomplish the task at hand. A few of these useful features include: a function jump menu for quick and easy navigation, a searching mechanism that allows the user to quickly find the information he wants, and an

easy-to-use online form that lets Lakeside (the company who owns the web site) know exactly what the user wants. This site is unanimously agreed to be a useful addition to the ever-expanding Internet.

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## **IMPROVING ADVOCACY FOR ABUSED AND NEGLECTED CHILDREN: CASA EVALUATION**

### Presenters:

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### Mentor:

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Court Appointed Special Advocates (CASA) is a not-for-profit organization that trains and monitors volunteers to advocate for the best interest of children involved in child abuse and neglect cases. The purpose of this mentorship is to evaluate the effectiveness of the CASA program and to discover new ways of improving old methods. We did this by studying files that were dismissed from CASA during 1997-1998. This information included: case resolution, placement at time of dismissal, age of children, length of time in court system, and length of time with CASA. We collected information on every file that has gone through the CASA program. We noted the year the case was opened and closed, number of children in each family, amount of time spent in the CASA program, and number of cases CASA serves each year. We studied lengthy cases to determine the factors that are preventing the cases from being dismissed within a reasonable amount of time. We collected various biographical information on the advocates and the children served. We surveyed agencies, advocates and caregivers involved with CASA. The collected data was compared to last year's research to determine trends, effectiveness of changes made, and areas which need improvement.

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## **MILITARY MAP READING PROGRAM**

### Presenters:

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We will develop a power point presentation that can be used by anyone (but probably the military) to train people to read maps. The most useful feature will be pictures of what terrain features look like on a map, what they look like from the air and what they look like from the ground. This will allow a much better grasp of what the cryptic symbols on the map really mean.

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## **THE BUILDING OF A RADIO ALARM CLOCK**

### Presenters:

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We will construct a digital electronic alarm clock (a very useful thing here at IMSA), that will also hopefully have a working AM and FM radio when complete. It will also have a battery backup power source as well as running of the wall current.

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## **PROBING THE BIRTH OF THE SOLAR SYSTEM**

### Presenter:

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### Mentor:

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Lawrence Grossman, Department of Geophysical Sciences, University of Chicago, 5734 South Ellis Avenue,  
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Unaltered remnants from the formation of the solar system reside as mineral pockets, called inclusions, in some asteroids, which may fall to earth. Meteorites containing these inclusions can give vital information on the specifics of the solar system's birth, such as what minerals formed as the solar nebula cooled. We employed a freeze-thaw method to separate the inclusions from the carbonaceous matrix of a 15-gram sample of the Murchison meteorite. Water was pumped into the pores of the meteorite using a vacuum dessicator; then we froze the water with liquid nitrogen. The frozen meteorite thawed naturally in an ultrasonic machine, gently breaking the meteorite apart. After twenty such cycles, the resulting powder was placed in a methylene iodide solution, with  $\rho = 3.18$ . The matrix, having a density less than this, floated to the top and was poured off. The denser material sank, and the minerals and inclusions of interest were handpicked under a microscope. The inclusions can now be analyzed with an electron microprobe and scanning electron microscope. The grain sizes, textures, and chemical compositions of the inclusions tell us how quickly they cooled and at what pressure, furthering our understanding of the origin of the solar system.

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## **MECHANICAL STRUCTURES IN FLUID SYSTEMS**

### Presenters:

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### Mentor:

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An airfoil in a steady uniform flow may undergo a variety of instabilities. As the flow speed is increased, one encounters oscillations that are due to the complex interaction of the fluid and the solid body. There exists theory

that predicts behavior for infinitesimally small motions; however, large amplitude motions are poorly understood. Computer programs have recently been written to simulate the phenomena. Currently, we are verifying that the computer simulations reproduce the small amplitude results of Theodorsen and Wagner theories; we are comparing the vortex wake patterns generated by the code to experimental results published in the literature. Further, we have written a program that generates computer animation of the complex wake formation process.

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## **DETERMING SIZE, SPEED, AND MASS OF THREE NEW THEROPODS**

### Presenters:

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### Mentor:

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In recent years, three new species of dinosaurs were discovered by teams working out of the University of Chicago. With incomplete skeletons and no living specimens, it is difficult to determine their size, speed, and mass. They can theoretically be estimated using skeletal ratios, Archimedes' Principle, and combinations of the practices of R. Alexander and George Demathieu. Because these methods often yield grossly varying results, all methods are discussed and various results presented. A footprint, of unknown origin, was found in the same layer as one species, Afrovenator. In an effort to determine if its trackmaker was indeed Afrovenator, the reconstructed pedal skeleton of Allosaurus, its closest known relative was necessary. To relate back to the original question, the print was comparative in size to Allosaurus, and therefore also to Afrovenator but has a different shape. Due to the resulting variance in methodologies, discernable patterns can be verified.

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## **AN INTELLIGENT MOBILE PLATFORM: AN EXPLORATION INTO ROBOTICS**

### Presenters:

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The objective of this project is to develop a comprehensive understanding of robotics and its implementation. To accomplish this, a mobile platform was constructed to assist in basic activities in an office environment, such as document and package delivery. A multi-disciplinary team was brought in from IMSA and Lucent. The project was broken down into two basic categories (hardware and software), and each of these into two further refined

categories (high and low-level subsystems). Two separate computers run onboard the platform. The hardware facets of this project include structural and mechanical design and implementation, micro-controllers, sensor arrays and communication subsystems. For the software, the relevant aspects include: asynchronous multi-threaded communication, multiple level API programming, a Linux-system interface, and programming in assembly/C. The micro-controller (a member of the Motorola 68HC11 family) controls the lower level systems on the platform. Momentary switches and infrared proximity sensors detect objects in the vicinity of the platform and, along with the electronic compass and accelerometers, allow the platform to connect to the outer world. An onboard computer provides the user interface and the processing power necessary to guide the platform. This application of robotics has the potential to help increase productivity in everyday life.

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## **INVESTIGATION INTO GOVERNMENT COMPLIANCE WITH THE ILLINOIS FREEDOM OF INFORMATION ACT**

### Presenters:

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

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The research for this project on the Illinois Freedom of Information Act (FOIA) and its many applications. Using the FOIA, three separate surveys were conducted to investigate how public bodies respond to FOIA requests. The initial survey involved electronic information and how the municipalities and townships in DuPage preserve electronic records in order to comply with FOIA requests. The second survey determined if state boards and commissions would release the names and addresses of their board of trustees or commission members. The third survey, which is still in progress, examines contracting policies from the townships and municipalities in DuPage and their availability to the public. The results from these surveys will be used to judge how public bodies respond to various FOIA requests and to analyze and compare current policies.

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## **RAPE: MYTHS AND REALITIES**

### Presenters:

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The emotional impact of rape upon an individual twists the heart and the victim's social perceptions. Rape affects the victim irreversibly and its power extends out from the one violated, poisoning their immediate world. Those who once approached life in a carefree manner, find themselves questioning their upbringing and the motives of those holding their trust. Rape appears in every country, in every culture and in all times. Most of society has

decided to deal with this issue by denying a problem exists or blaming the victim. To look at how rape affects the victim and their place in society, one must understand the characteristics of both victims and rapists, how the act of rape affects any relationship the victim has and what social patterns contribute to the belief of rape myths. These topics will be brought to light using personal stories, facts and analysis.

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## **THE NUMBERS OF WIZARD STREET WITH CHILDREN IN CABRINI GREEN: THE PSYCHOLOGY OF LEARNING**

### Presenter:

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### Mentor:

Mr. George Colone, Associative Executive Director, Community Youth Creative Learning Experience (CYLCE),  
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The idea that one must have basic mathematical foundations (addition, subtraction, multiplication) before advanced theories can be conceptualized is a common mistake. Many assume that the very young cannot learn those skills taught at the high school level. Subjects such as trigonometry, algebra, and geometry must be presented in a way that focuses not on the actual computation of an equation, but the concepts behind them. Children in kindergarten through eighth grade were presented with these types of challenges. We focused heavily on the geometric theories involving triangles and space. Many of the labs were founded on Piaget's theories of association [Piaget, J and Indleder, B and Szeminska, A. The Child's Conception of Geometry. NY WW Norton & Co., Inc.]

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## **PEARL DIVING IN THE PERSIAN GULF**

### Presenter:

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### Mentor:

Dr. Bennet Bronson, Curator of Asian Archaeology and Ethnology, Field Museum of Natural History, Roosevelt  
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In terms of pearl diving, the Persian Gulf proves one of the most exciting regions in the world. It is one of the oldest recorded sources of pearls. Pearl diving there managed to flourish until the early 1900's, after which it dropped off. This may have been caused by the rising popularity of Japanese cultured pearls. Yet still today the nations in the region hold pearl diving as a piece of their heritage and something to be proud of. Topics such as the lifestyle of a pearl diver, how to distinguish an outstanding pearl from one of lesser value, and uses of pearls in jewelry have been researched and will be presented. Research has been in cooperation with the American Museum of Natural History in New York and will be the topic of a future joint exhibit on pearls.

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## **THE STARVED ROCK PROJECT**

### Presenter:

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Between 1683 and 1691 Fort Saint Louis des Illinois served as the headquarters of the French empire in the Middle West. Traders and Indian war parties from the fort defended French influence from the Iroquois Confederacy which also sought to extend their influence in the region. The post played an important role in the history of colonial America and early Illinois. Despite this, the average Illinoisan knows next to nothing of its history. By means of work on the diorama and work with primary and secondary texts, my inquiry is directed at alleviating this woeful ignorance.

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## **STUDY OF GALVANIC CURRENT IN THE FORM OF IONTO- AND PHONOPHORESIS**

### Presenter:

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

### Mentor:

Mr. Kevin Pennington, Department of Physical Therapy and Rehabilitation Services, Delnor Hospital,  
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Since its discovery in the early 1900's, the use and importance of electric current in medical practice has been widely recognized. In the 1960's, it was learned that such current could be used to infuse medication into the body through the skin rather than topically or orally. This method enabled the medicine to reach the bloodstream sooner and thus act more rapidly. Iontophoresis uses uninterrupted current to implant Dexamethosone steroid through the skin to aid in soft tissue repair and restabilization. Phonophoresis uses ultrasound currents to carry hydrocortisone steroid in a diluted sterile solution through the skin to break up muscular scar tissue and help in tissue repair. In the past 10 years, the knowledge of these processes has increased rapidly, and recently the effect of electric current on animals is being studied. Scientists have started to use iontophoresis on horses to cure muscular diseases and other tissue damage with positive results.

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## **SNELL'S LAW AND ITS RELATION TO LIFE**

### Presenter:

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### Mentor:

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From the study of consciousness to Bose-Einstein Condensate, refraction plays an important role in the nature of current theory. The law in geometric optics that governs this phenomenon, Snell's Law, is a place for connections to be made in both scientific and historical areas. It has been my work to target a few of these connection areas in order to more fully understand the phenomenon known as refraction.

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## **NAFTA: THEN AND NOW**

### Presenter:

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### Mentor:

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One of the greatest issues in the 1992 presidential elections was the North American Free Trade Agreement, or NAFTA. This groundbreaking agreement that would break down trade barriers between the United States, Canada, and Mexico, was on the minds of many Americans, from the working class to politicians and large corporations. President Clinton, a NAFTA supporter, was elected, and the trade agreement was ratified and put into effect on January 1, 1994. Now, five years later, the previously controversial topic is scarcely mentioned in the media. This project will investigate the real effects of NAFTA and how they compare with the wide-ranging predictions made before its inception.

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## **IMMUNOLocalIZATION OF GLIAL FIBRILLARY ACIDIC PROTEIN (GFAP), RHODOPSIN, AND GLUTAMINE SYNTHETASE IN LIGHT DAMAGED RETINAS OF CD-1 MICE**

### Presenter:

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### Mentors:

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The purpose of this research was to study the effects of light damage on the retina by investigating the changes in protein synthesis. This study involved the immunolocalization of three proteins -- glial fibrillary acidic protein (GFAP), a structural protein that is usually present in low levels in normal retina; rhodopsin, a protein found in the rod photoreceptors; and glutamine synthetase, a metabolic enzyme. Female albino mice of the CD-1 strain were exposed to fluorescent light for intervals ranging from 24 hours to 45 days to induce retinal degeneration. Frozen sections were then reacted with antibodies using a fluorescent immunocytochemical technique. The results showed a marked increase in the level of GFAP that was proportional to light damage and photoreceptor degeneration. Rhodopsin showed an initial decrease and eventually disappeared. Staining with glutamine synthetase was present all the way through 45 days of light exposure with no discernable change in intensity. These observations show that retinal degeneration affects the synthesis of several proteins in the retina, specifically GFAP, rhodopsin, and glutamine synthetase.

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## **MILITARY REVEILLE AND RETREAT CEREMONIES TRAINING VIDEO**

### Presenters:

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### Advisor:

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A videotape will be produced by the group, which will be used to train military and R.O.T.C. Units in Army and Air Force Reveille and Retreat ceremonies. The program will touch on the history of the ceremony, relevance of the protocol, military customs and courtesies, as well as specific and detailed procedures for performing these ceremonies.

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## **ACTIVITY LEVELS IN MALE JEWEL WASPS, MATED VS. VIRGIN**

### Presenter:

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### Mentor:

B. King, Department of Biological Sciences, Northern Illinois University, DeKalb, IL 60115; bking@niu.edu

Activity levels in virgin male *Nasonia vitripennis*, parasitoid wasps, were compared to activity levels in mated males through observation in a terrarium. There was no significant difference in activity level. Age of the wasps and temperature and relative humidity of the test dates did not influence results.

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## **THE EFFECTS OF THE ENTERTAINMENT INDUSTRY AND MAINSTREAM MEDIA UPON AMERICAN MORALITY AND CULTURE**

### Presenter:

Mirjana Jankov, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; USA; 630-907-5430; miyam@imsa.edu

### Mentor:

Marie Haugh, History Programs, Chicago Historical Society, 1601 North Clark Street, Chicago, IL 60614-9963; 312-642-5035 ext.385; haugh@chicagohistory.org

America, at the turn of the century, was beginning a public decline of morality, hypothesized to be due to a more widespread media onslaught (i.e. magazines, film, etc.) by the growing entertainment industry. Topics breached by media sources became more racy as the century progressed, influencing numerous generations of young adults. The media began to allude to sex, particularly pre-marital sex, "kept" women, and drugs. People were gently persuaded that there was a more exciting life to be found past the boundaries of a standard American compliance to work, home, and family. This willing attitude to change led to developments for the equality of women in politics and daily life.

## **THEMES IN TWENTIETH CENTURY SHORT STORIES**

### Presenter:

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Mainstream British and American Literature in the first half of the twentieth century took on certain tones, subject to societal occurrences, perceptions, and ideals. The form of the short story took on its own particular trends and themes. Historical occurrences such as World War I and II, the Roaring Twenties, and the Depression all left their indelible mark upon the social psyche. The rise of the middle class also called for a change in the types of characters the stories included. An influencing factor of technique was that the short story was distributed mainly in magazines, forcing the short story to have many twists and turns to leave the reader with a "cliffhanger" that would call him back in next month's issue. These trends will be exemplified in a short story written by the presenter, read to the audience, followed by a brief discussion of the specific themes, techniques, and why society, at that time, found them to bear such appeal.

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## **SEROTONIN RECEPTORS**

### Presenter:

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### Mentors:

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Adil Javed, Graduate Student, Department of Cell Biology and Neuroanatomy, Stritch School of Medicine,  
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Serotonin is a major neurotransmitter in the brain. It helps regulate various physiological functions such as eating, sleeping, body temperature and sexual behavior. Drugs that are used to treat many psychiatric disorders are thought to act by altering brain serotonin. Serotonin is produced in a small area of the brain called the raphe nucleus. The raphe brain cells are connected to widespread areas of the brain through nerve terminals that release serotonin. Serotonin acts by attaching to receptors located in the membrane of these distal nerve cells. These receptors recognize the serotonin neurotransmitter resulting in the cell being activated or inhibited. There are many different types of serotonin receptors. Some are inhibitory and some are excitatory. When a nerve cell is excited enough it will communicate to another cell by releasing its own neurotransmitter. If a cell is inhibited, then it will do nothing. It is important to locate the different types of serotonin receptors in areas of the brain that are responsible for causing depression and anxiety. The receptors are marked by using a technique called immunohistochemistry. The maps created through this procedure can be evaluated to better explain and find cures to disorders such as depression. This presentation provides a description of how serotonin and its receptors combine to have their biological effect.

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## NON RADIOACTIVE LABELING OF K562 TARGET CELLS

### Presenter:

Kiarash Javanmardian, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506 USA; 630-907-5745; kiarash@imsa.edu

### Mentor:

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The immune system protects the body from infectious organisms by a variety of means; one of these is the production of cytotoxic lymphocytes capable of destroying cells which harbor intracellular bacteria or viruses. Function of cytotoxic (effector) lymphocytes is usually measured by the release of an intracellular label from target cells. Traditionally, target cells are labeled with radioactive chromium ( $^{51}\text{Cr}$ ) chloride. As an alternative, a non-radioactive fluorescent compound (europium, Eu) may be used to label target cells. Human natural killer susceptible (target) cells (K-562) are labeled with Eu together with a chelator, DTPA. Eu-DTPA solution is added to  $10^6$  K562 cells suspended in Hepes buffer, pH 7.5. With the addition of a dextran sulfate solution (DXS), the cell membrane is made porous and Eu-DTPA enters the cell. Repairing buffer is later added to reseal the cell membrane trapping the Eu-chelate within the cell. Upon lysis, the target cells releasing the chelate into the surrounding culture medium. The amount of chelator released is directly proportional to number of cells lysed. An enhancing solution containing a second chelator which increases the fluorescent capability of Eu by nearly 10,000 fold allowing the amount of released Eu to be quantified through time-resolved fluorescence analysis.

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## THE ROLE OF ESTROGEN RECEPTOR- $\alpha$ (ER $\alpha$ ) IN THE DIFFERENTIATION OF FIBROBLASTS INTO SMOOTH MUSCLE CELLS IN THE MOUSE VENTRAL PROSTATE

### Presenter:

Jane Jih, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506 USA; 630-907-5408; jj99@imsa.edu

### Mentors:

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Lynn Janulis, Ph.D., Post-Doctoral Fellow, Department of Urology, Northwestern University Medical School, Tarry Building 11-715, 303 East Chicago Avenue, Chicago, IL 60611-9003 USA; 312-908-7963; l-janulis@nwu.edu

In the prostate, estrogen acts upon estrogen receptor - $\alpha$  (ER $\alpha$ ), present in the stroma, to elicit its biological effects. Previously, estrogen was found to induce transforming growth factor- $\beta$  (TGF- $\beta$ ) expression in prostatic stromal cells. Additionally, it has been reported that estrogen can enhance smooth muscle phenotype. Because smooth muscle is inhibitory to prostate growth, we have hypothesized that ER $\alpha$  knockout (ERKO) mice will demonstrate larger prostates with diminished expression of smooth muscle in comparison to wild type controls. Furthermore, we have postulated that ER $\alpha$  mediates the differentiation of fibroblasts into smooth muscle cells by the production of TGF- $\beta$ . Herein, we have investigated the role of estrogen in prostate growth and in the morphology of prostatic stromal cells using the ERKO mouse as a model. In this study, immunohistochemistry has been used to detect the presence of TGF- $\beta$  and smooth muscle myosin, a marker for smooth muscle phenotype, in the ventral prostates of ERKO and control mice. We have found that the ventral prostates of ERKO mice contain less TGF- $\beta$  in comparison to those of controls, although no obvious differences in smooth muscle myosin have yet been discernable. Our results suggest that TGF- $\beta$  is an important mediator of estrogen action within the prostate.

## **PEPSI: SATISFYING THE CONSUMER-ADVERTISING IN JAPAN**

### Presenter:

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### Mentor

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

"PepsiCo Inc. and Suntory Ltd. based in Tokyo have joined forces to supply the Japanese market. Suntory will be franchised to sell PepsiCo products and plans to expand its cold beverage business by 30% through March of 1999"(Foodservice Yearbook International, 10/13/97). Without the help of corporations in Japan, an American company would find it difficult to succeed in the Japanese market. With the help of Suntory, Pepsi is able to present its product to the Japanese consumer in a manner that is acceptable to them. An in depth analysis of Pepsi's advertisements and package designs in the United States was surveyed in part one of this presentation. Through this analysis we learned how Pepsi was portrayed to the American consumer. This year, in part two of this presentation, an in depth analysis of the Japanese carbonated beverage culture as it relates to advertising and package design will be surveyed. Through this analysis we will see how Pepsi should be portrayed to the Japanese consumer. Using this information, a commercial will be created that will reflect the concepts learned about Japanese culture. Overall, the purpose of this project is to highlight the important components that are necessary in carbonated beverage advertising in Japan.

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## **INVOLVEMENT OF FIBROBLAST GROWTH FACTOR IN PREIMPLANTATION MICE EMBRYOS**

### Presenter:

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### Mentor:

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In the early mammalian embryo communication between three cell lineages is essential for life. As the embryo implants into the uterus the 1) embryonic precursor cells, 2) placental precursor cells and 3) yolk sac precursor cells are present. Our lab has shown that a single family of communication proteins, called Fibroblast growth factors (FGF) are essential for the life of the implanting embryo. All three cell lineages require this family of growth factors for growth and survival of the embryo. Our lab has shown that when the receptor proteins for FGF are blocked, the embryonic cells stop growing two days before implantation. There are several hypotheses which involve this, but one hypothesis is that other FGF proteins beside FGF-4 may be in the embryo transiently and protect the embryo from the loss of FGF-4. We have looked for other FGF proteins in the preimplantation embryo, and found that it contains the mRNA molecules that enable it to make FGF-10 and FGF-8. We wish to find 1) if these FGF-10 and FGF-8 mRNA molecules are found transiently, 2) if the FGF-10 and FGF-8 proteins are synthesized, 3) and which of the three cell lineages synthesize the FGF-10 and FGF-8 protein.

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## RESURGENCE OF DISEASES IN RELATION TO CIVIL DISCORD IN AFRICA

### Presenter:

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Since the 1960's, sub-Saharan Africa has experienced both some of the most horrific civil wars and disease breakouts in history. By examining specific events during this time frame, it is clear that actions made by societies and nations have the ability to affect the potential of various diseases. The 1970 cholera epidemic, the 1995 Ebola outbreak in Congo-Kinshasa, AIDS, and current malarial outbreaks will be discussed to demonstrate these relationships. The effects of geography, climate, religions, and international aid on society and disease will also be covered. The refugee movements, overcrowding in cities, and alteration of the topography have created an alarming situation for public health in Africa. Because of the continent's unique situation, it may give rise to a dangerous rival to mankind in the coming century. Information included in previous studies on diseases [McNeill W, *Plagues and Peoples*. Garden City, New York: Anchor Press/Doubleday, 1976], on past African epidemics [Stock R, *Cholera in Africa*. Plymouth, England: Clarke, Doble, & Bendon Ltd, 1976], and the situation in West Africa during the 1990's [Kaplan, R, "The Coming Anarchy." *Atlantic Monthly* Feb. (1994): 44-76.] will be vital. After the problem is addressed, possible solutions will be given.

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## THE EFFECTS OF STRESS ON SALIVARY CORTISOL LEVELS IN HUMANS

### Presenters:

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### Mentor:

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Cortisol, produced by the adrenal glands, is a steroid hormone that helps the body cope with stress. The body's cortisol levels are affected by eating patterns and physical or mental activity. The secretion is promoted by ACTH, triggered, in turn, by CRH. This increases cortisol levels that feed back to trigger the hypothalamus and anterior pituitary to prevent CRH, ACTH and cortisol release. The level of salivary cortisol has been shown to increase due to an applied stressor. In this study, the affects of the two stressors have been compared to find the most effective means of raising cortisol levels. The results will be used in a study on how cortisol affects drug abuse. In this study, sixteen volunteers were asked to attend one two-hour session. They were given either an arithmetic test in front of a video camera, or were exposed to physical stress by way of a stationary bicycle. During this time, their heart rate, blood pressure, and temperature were monitored while completing frequent self-report mood questionnaires. The physical tests were found to raise cortisol levels higher and more consistently than the mental stressor.

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## **TOWARD THE SYNTHESIS OF TETRACYCLIC QUINOLONES: THE SYNTHESIS OF AMINO ACID DERIVED PIPERAZINES**

### Presenter:

Christen Klochan, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506  
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### Mentor:

Dr. Robin M. Zavod, Assistant Professor of Pharmaceutical Sciences, Chicago College of Pharmacy, Midwestern University, 555 31<sup>st</sup> Street, Downers Grove, IL 60515; 630-515-6478; rzavod@midwestern.edu

Agents that function as DNA gyrase inhibitors kill bacteria by preventing the replication and storage of double stranded DNA. It is known that certain functional groups on the fluoroquinolone nucleus are partially responsible for its biological activity. The C-7 piperazine substituent and associated derivatives have been studied, but the effect of substitution placement and chirality has not been well established. It is also unclear what role different functional groups and their positions on the piperazine play in determining the activity of the antibacterial agent. Our overall strategy in synthesizing tetracyclic quinolones is to enable the piperazine moiety to be bound in a rigid conformation, such that the importance of functional groups and their relative positions in space can be observed. This study should eventually lead to a more comprehensive understanding of the molecular mechanism of action of this class of commercially available chiral amino acids. Each piperazine will ultimately become a C-7 substituent on a common quinolone nucleus being synthesized by a post-doctoral fellow in our laboratory. Once these agents are synthesized, purified, and appropriately characterized, they will be tested for relevant antibacterial activity.

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## **CONSTRUCTION OF SILICON CARBIDE MICROPIPES: ANALYSIS**

### Presenter:

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### Mentors:

Professor Yury Gogotsi, Mechanical Engineering Dept., University of Illinois at Chicago, Chicago Illinois 60607 USA; 312-996-9631; ygogotsi@uic.edu

Michael Gardner, Mechanical Engineering Dept., University of Illinois at Chicago, Chicago Illinois 60607 USA; 312-995-0478; mgardn3@uic.edu

The previous year, an investigation was made into the feasibility of a method for the creation of SiC micropipes. It was found that the method, which consisted of the removal, by high temperature oxidation, of a carbon core fiber from its silicon carbide outer coating, was indeed capable of creating micropipes with an outer diameter of ~120 microns and an inner diameter of ~40 microns. With this in mind, the next objective was the analysis of the oxidation mechanism, and the development of an empirical formula relating the recession of carbon in the inner channel of the micropipes to the duration and temperature of the firings. The accuracy of this formula is to be determined by comparison with experimental data gathered throughout the term. While some progress towards this end has been made, significant work remains to be done. The most recent results and their comparison to predicted values will be discussed. Finally, some possibilities for further research in this field will be suggested, along with future applications of the technology.

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## CHARACTERIZATION STUDIES IN FUSED DEPOSITION RAPID PROTOTYPING

### Presenter:

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### Mentor:

Selçuk Güçeri, Professor and Department Head, Department of Mechanical Engineering, University of Illinois at Chicago, Chicago, IL 60607 USA; 312-996-5096; guceri@uic.edu

Rapid prototyping describes a class of technologies geared toward the purpose of fabricating solid 3-dimensional parts from computer-generated CAD models. The CAD models are cross-sectionally sliced and converted into X-Y coordinates that are sent to the machine for building layer by layer. This specific research deals with the Fused Deposition (FD) method used by the STRATASYS FDM 1650 machine. In FD, filament material is heated and extruded through a nozzle several thousandths of an inch in diameter that moves along the X-Y plane to lay down "roads" to fill each layer. Characterization of potential materials for use in FD is being explored using various methodologies. Default materials for building parts have been ABS polymer and ICW wax. Ceramic particle-filled filaments are being produced at Rutgers University, along with a FD machine with multiple nozzle heads for multiple materials. The materials research is geared toward determining usability in current machines and quality of finished parts. Observing the performance of square-nozzle heads versus round is important for reduction of air voids between roads that become critical in binder burnout in making ceramic parts. Exporting Magnetic Resonance Imaging (MRI) data directly into making models of biological parts is also being investigated.

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## STUDY OF THE HMR INDUSTRY

### Presenter:

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### Mentor:

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Due to the increase in its work force, the American public is moving towards a more efficient lifestyle. Such a change has sparked the resurgence of the home-meal replacement (HMR) industry. HMR is comprised of meals and components that are freshly prepared away-from-home and are ready-to-eat. The rise of this industry has provoked various conflicts within the world of foodservice. Information pertaining to the background and development of this industry will be presented.

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## RITA AND EUNICE ROCK THE WORLD: PART ONE SUPPRESSION OF HIV-1 BY CD8+ T-CELLS IN PEDIATRIC PATIENTS

### Presenters:

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### Mentor:

William Kabat, Supervisor of Research Infectious Disease Laboratory, The Children's Memorial Hospital, 2300 Children's Plaza Chicago, IL 60614; 773-880-4907; wkabat@nwu.edu

After examining the longitudinal quantitative HIV co-culture patterns of pediatric patients, we categorized them into four groups: indeterminate, positive, zigzag, and suppressor. In particular, we focused on those patients we

viewed as suppressors, where we were able to detect in vitro inhibition of HIV-1 expression. We used previously isolated culture supernates from each of these categories to determine whether a suppressor factor(s) from these patients also had the same effect on exogenous viral expression. We performed the HIVAG-1<sup>TM</sup> Monoclonal assay (Abbott Laboratories), a quantitative sandwich enzyme immunoassay used to detect HIV-1 p24 antigen as a measure of viral activity. Our long-term goal is to show that the quantitative HIV-1 co-culture of these patients secrete a protein or combination of proteins that aid in inhibiting virus replication and can be used to measure cellular suppressor status and cellular viral burden.

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## **PEDIATRIC AIDS: HIV-1 VIRAL BURDEN, CD4/CD8 COUNTS, AND THE ROLE OF VPR IN DISEASE PROGRESSION**

### Presenters:

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Jill Starzyk, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, Illinois 60506; 630-907-5649; jacksgirl@imsa.edu

### Mentor:

Yuqi Zhao, Ph.D., Director of Molecular Diagnostics Laboratory, Children's Memorial Hospital/Northwestern University Medical School, 2430 N. Halsted Street, No. 218, Chicago, Illinois 60614; 773-880-6608; yzhao@nwu.edu

There are over one million children in the United States currently infected with the human immunodeficiency virus type 1, commonly known as HIV-1 or AIDS. Clinical symptoms of AIDS are characterized by an increase of viral burden and decrease of CD4 T-lymphocyte counts. Recent developments of cocktail therapy are able to eliminate most of the virus and restore human immune functions in a very short period of time, thus raising the hope for complete eradication of viral infection. In this study, viral burden and CD4/CD8 counts of 92 HIV-infected children are plotted over the course of infection to show different rates of disease progression and responses of these patients to cocktail therapy. Because T-lymphocytes maintain a blind homeostasis, the fall of CD4 counts often instigates an increase in CD8. Comparisons between CD4 and CD8 counts yield three basic relational graphs: fluctuation of CD4/CD8 levels, the typical decline of CD4/increase of CD8, and finally, stable CD4 levels. While a decline in CD4 illustrates damage caused by an active virus, an increased or stable CD4 level may indicate effective antiviral therapy or strong immune functions contributed by other cellular or viral factors that are keeping these patients alive. The median survival age for perinatally infected individuals is approximately five years. Those living past the age of eight with stable CD4 counts are classified as Long Term Survivors (LTS). Preliminary results conducted in Dr. Zhao's laboratory have suggested that genetic and functional defects in the viral protein R (Vpr) are some of the factors that are contributing to little or no disease progression in some of the HIV-infected patients. The handicapped Vpr is incapable of successful attacks on CD4 T-cells and weak in its ability to support viral replication.

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## **AGENT-BASED MODELING OF ANCIENT PERUVIAN COASTLINE VILLAGES**

### Presenter:

Alan L. Liu, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506, USA; 630-907-5731; surak@imsa.edu

### Mentor:

Jonathan Haas, MacArthur Curator, North American Anthropology, The Field Museum, Roosevelt Rd. at Lakeshore Dr., Chicago, Illinois 60605; 312-922-9410 ext. 641; haas@fmppr.fmnh.org

Efforts to accurately model societies and consequently develop a unified theory concerning changes in culture have long been hindered by an inadequate understanding of human interaction, behavior, and history. One way to overcome this barrier is by using agent-based modeling, an implementation where certain "rules" are programmed into a virtual individual, defining the behavior of that individual towards other individuals and towards its

surrounding environment. These individuals are allowed to “tinker” with parts of their environment and culture. When successful, this can lead to widespread cultural evolution and may have a dramatic impact on the organization of the society. The platform of choice to employ such agent-based modeling is Swarm, developed at the Santa Fe Institute. Using Swarm, an initial model of an ancient Peruvian coastline will be presented.

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## **BEAUTY OF YELLOWSTONE: A JOURNEY OF PHOTOGRAPHS**

### Presenter:

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### Advisor:

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This photographic work is a collection of my journeys during the fall semester (1998-1999) to Yellowstone, WY, Wolf Park, IN, and local wildlife reserves. Several series of photographs have been created to portray the emotions present throughout the legal disputes surrounding the wolf reintroduction in Yellowstone and the research studies performed at Wolf Park. Black and White as well as color film was used to capture my emotions surrounding wolf interactions and the “fight for life” beauty of nature.

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## **MUSICAL COMPOSITION FOR PIANO**

### Presenter:

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

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Multiple pieces were written to explore various musical techniques, and to increase my comfort and facility with composition. These compositions followed and were inspired by the study of works by composers such as J. S. Bach, Debussy, Beethoven, Haydn, and others. The works studied exhibited the musical ideas of contrapuntal themes, melodic and harmonic bass lines, series, and varying modes. I have attempted to explore these techniques in my music, as well as ideas such as the build-up and flow of phrasing, emphasis through rests and perpetual sixteenth notes, melodic purpose, and both classic and unusual harmonies. This study of musical composition has improved my understanding of musical structure and purpose, both for future writing and for piano performance, and helped me express myself through music. My presentation will combine a brief explanation of the above ideas in conjunction with the performance of several original pieces.

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## **RECURRENCE QUANTIFICATION ANALYSIS OF THREE-DIMENSIONAL PROTEIN STRUCTURES**

### Presenter:

Saugar Maripuri, Illinois Mathematics and Science Academy, 1500 W. Sullivan Rd, Aurora, IL 60506

### Mentor:

C. L. Webber Jr., Department of Physiology, Loyola University Chicago, Stritch School of Medicine, Maywood, Illinois 60153

Chains of amino acids that ultimately form proteins reside in characteristic patterns in three-dimensional space, which could include beta-barrels and alpha-helices. It is hypothesized that Recurrence Quantification Analysis, a computer algorithm that utilizes nonlinear dynamics to mathematically represent recurrent systems, can discern these characteristic patterns within three-dimensional protein data. Structural data was obtained from the Brookhaven National Laboratory's Protein Databank and converted from standard coordinates to three-dimensional distances between respective alpha-carbons on each amino acid. This data was then subjected to Recurrence Quantification Analysis. Another important inquiry that was explored connected recurrence data to a protein's function. In this instance, proteins of differing and similar function were compared using data obtained through Recurrence Quantification Analysis. Results of each of these studies will be presented.

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## **INVESTIGATION OF HOW MUTATIONS IN LARGE T-ANTIGEN AFFECT SV40 GROWTH**

### Presenters:

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Gihoon Sung, Illinois Mathematics and Science Academy, 1500 W. Sullivan Rd., Aurora, IL 60506 USA;  
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### Mentors:

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Marlena Wilson, Department of Microbiology/Immunology, Northwestern Medical Center, 710 North Fairbanks, Chicago, IL 60611, USA; 312-503-5917

Simian Virus 40 (SV40) is an oncogenic simian polyomavirus, whose DNA sequences have recently been detected by polymerase chain reaction (PCR) assays in a variety of human tissues. In addition to tumors, SV40 DNA sequences have been found in the human pituitary gland tissue, peripheral blood mononuclear cells, and seminal fluids of healthy individuals. T-antigen, a multifunctional phosphoprotein of SV40, is necessary for virus DNA replication and for the regulation of viral gene expression in infected cells. A mutation in T-antigen has been identified that no longer blocks apoptosis, programmed cell death. The study aims to determine whether this mutant protein will affect the growth of SV40. A plasmid containing the SV40 sequence with the mutation in T-antigen was constructed and used in an effort to make virus. No virus was made, although the wild-type plasmids generated virus. Through the analysis of western blots, it was determined that the mutant T-antigen was made in normal levels. The ability of T-antigen to allow viral DNA replication is being analyzed. In the future, the effects of mutant and wild-type sequences on apoptosis will be examined through the microscopic examination of transfected cells. These studies may conclude that the ability to regulate cell death is necessary for the growth of SV40 virus.

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## **EXPLORATION IN ART, FOCUS OF IMPRESSIONISM**

### Presenter:

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### Advisor:

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

An extensive research (10+ hours) on Impressionism and the artists of the era throughout the beginning of the first semester was integrated into producing original pieces of artwork. There was an attempt to use the Impressionism style in each picture and to show various uses of media. Also included will be two pictures produced with Window's Paint. The display will show these pieces with an explanation for each: media, style, background. A comparison between these and other known works will be stated.

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## **STIQUITO AND LABVIEW: ADVANCED EXPERIMENTS WITH A SIMPLE ROBOT**

### Presenters:

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Simone Washington, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506;  
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### Mentor:

Dr. Richard L. Magin, Head Bioengineering Department, University of Illinois at Chicago, 851 South Morgan Street, Room 212, Chicago, IL 60607-7052; 312-996-2335; rmagin@uic.edu

We experimented with simple ways to construct a cockroach-like robot. The purpose of this is two-fold: one, to develop a sophomore level laboratory course in bioengineering at UIC and two, to continue experimentation in the use of robotics in the future. With final completion of the robot, control was established through a simple manual controller. After that we looked for more complex and independent ways using a PC to control Stiquito with the aid of LabView software. LabView is a structured program environment that utilizes icons as the main means of creating your own program. The construction of the robot, interfacing, its applications, and our current progress will be discussed.

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## **A STATISTICAL ANALYSIS OF THE CHARMED MESON DECAY AND ITS RELATIVISTIC EFFECTS**

### Presenter:

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### Mentor:

T. Jordan, Education Office, Fermi National Accelerator Laboratory, Batavia IL 60510 USA; 630-840-4035;  
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The charm meson is one of many exotic particles with very short lifetimes that make up our universe. A fixed target experiment at Fermilab produced many charmed mesons so that their properties could be studied. The mesons left their target at very high speeds, entering detectors which could observe their decay. We were interested in determining a relationship between a meson's momentum and its decay length. In order to determine this, certain statistical processes must be applied to the data as well as the application of key ideas from classical mechanics. Our intuition told us that an increase in momentum would produce an increase in the distance traveled before decay. We found this to be generally true. However, the observed decay lengths were always

longer than we expected. Different mathematical and physical models have been applied to understand this discrepancy. Following this study, these data will be available on the web to allow high school students to investigate this phenomena.

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## **DETECTION OF FOLLICLE STIMULATING HORMONE RECEPTORS (FSHR) ON HUMAN GRANULOSA CELLS (GC) BY FLOW CYTOMETRY**

### Presenter:

Jacqueline McKenna, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, Illinois 60506; jem1018@imsa.edu

### Mentors:

Dr. Judith Luborsky, Associate Professor and Director of Endocrine Immunology, Department of Obstetrics and Gynecology, Rush University Medical College, Chicago, Illinois 60612; jluborsk@rush.edu

Dr. Prakash Thiruppathi, Reproductive Endocrine Fellow, Department of Obstetrics and Gynecology, Rush University Medical College, Chicago, Illinois 60612; nidhi@msn.com

The follicle stimulating hormone receptor (FSHR) is essential for the cyclic growth and differentiation of the ovarian follicle. Some women with infertility do not respond adequately to stimulation of the ovary with FSH during infertility treatment. The objective was to detect FSHR, required for a FSH response, on human granulosa cells (GC). The approach was to optimize detection by using a genetically engineered cell line (CHO cells) that expressed FSHR. Various concentrations of a specific antibody to FSHR were assessed. Bound antibody was detected with a second antibody labeled with a fluorescent probe (FITC) and the fluorescence measured with a flow cytometer. The number of receptors per cell were determined using quantitative microbeads with a known number of antibody binding sites as a standard. The same method was applied to human GC of IVF patients collected at the time of oocyte retrieval under a protocol approved by the Institutional Review Board. The estimated number of receptors detected on CHO cells was 15,423 per cell. The range estimated for human GC was 1,806-6,113. This study has shown that it is possible to detect and quantify FSHR using flow cytometry and a specific FSHR antibody. It can also be the basis for further study of altered receptor number as a possible basis for poor responses to hormone in some women with infertility.

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## **MAGNETIC FIELD INHOMOGENEITIES ASSOCIATED WITH THE ARCHIMEDES SPIRAL COIL GEOMETRY**

### Presenters:

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Akhil Narang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; 630-907-5238; akhil@imsa.edu

### Mentor:

Dr. Alan Feinerman, Professor and Director of Microfabrications Applications Laboratory, Department of Electrical Engineering and Computer Science, University of Illinois at Chicago, Chicago, IL 60612; 312-996-2313; feinerman@eecs.uic.edu

Currently, magnetic coils used to measure absorbencies in Nuclear Magnetic Resonance (NMR) spectra distort the applied magnetic field. This distortion spreads out the NMR signal's frequency, yielding inaccurate and imprecise results. Our research consists of testing a novel coil design, shaped as an Archimedes Spiral – which in theory should minimize the distortions. This coil scheme closely resembles the magnetic field of an infinite cylinder – which produces no distortions. Cuts, or slits in the wafer, redirect the current and magnetic distortion. The applied current is axially confined by making cuts in the wafer, parallel to the cylinder's axis. The cuts are then lithographically defined such that they are exposed on the equator of the cylinder when placed in the magnetic field. These slits on the equator control the path of the current and minimize the magnetic field

disturbance. This theory needs to be further scrutinized and tested in order to ensure the accuracy of the hypothesis. Initial project designs are coded for, modeled and analyzed using a variety of specialized software. Eventually the coil is lithographically constructed and the final product(s) are tested. Practical applications include increasing the signal to noise ratio in the NMR spectra.

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## **DETERMINING THE REST MASS OF THE CHARGED K-MESON**

### Presenter:

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630-907-5506; elrond@imsa.edu

### Mentor:

Daniel Kaplan, Biological, Chemical, and Physical Sciences, Illinois Institute of Technology, Life Science Building, 3101 South Dearborn Street, Chicago, IL 60616; 312-567-3389; kaplan@fnal.gov

The rest mass of the charged k-meson is not known very accurately in comparison with other stable particles. There is a disagreement between the two most accurate experiments of 60 keV [C. Caso, et al. Euro. Phys. J. C3 (1998)]. My research focused on calibrating data from a previously run experiment in order to determine that mass to 20 keV. The program PAW, Physics Analysis Workstation, was used to analyze the data and make the corrections. The calibrations were made using the mass of a pion, known to 350 eV. The two main problems are the alignment of the mirrors and the field of the bending magnet. The mirrors reflect the Cherenkov radiation given off by the particles onto photon detectors. From the angle at which the radiation was emitted we can arrive at the velocity of the particle. The magnets deflect the particle by an amount related to the momentum. The mirrors move out of alignment and the magnetic field is not constant and is only known to one percent. Also the index of refraction of the gas in the Cherenkov detector can change over time, which also needs to be corrected for. The k-meson mass is derived from the momentum and velocity.

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## **DETECTION OF BETA 2 ADRENERGIC RECEPTOR EXPRESSION IN FOUR GENERATIONS OF CD4+ TH1 AND TH2 EFFECTOR CELLS DERIVED FROM CD4+ NAIVE T CELLS**

### Presenter:

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### Mentor:

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### Advisors:

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Naive CD4+ T lymphocytes develop in the thymus and leave the thymus to reside in lymphoid tissues containing nerve fibers that release the neurotransmitter norepinephrine. Norepinephrine signals a cell via the Beta-2-Adrenergic Receptor (B2AR) that is present on various cell types, including immune cells. When naive T cells are exposed to antigen and the cytokine interleukin (IL)-12, they differentiate into T helper-type 1 (Th1) cells, but when exposed to antigen and IL-4, they differentiate into Th2 cells. Our laboratory has shown that Th2 clones do not express the B2AR, while Th1 clones do. These data allowed us to hypothesize that Th1 cells generated under conditions that are less estranged from the natural environment should express the B2AR, while Th2 cells should not. To address this possibility, we isolated mouse naive T cells and drove these cells with antigen and cytokines to promote their differentiation into Th1 and Th2 cells. To verify if differentiated cells were Th1- or Th2-like, the cytokine profile of four generations of cells was analyzed using an ELISA. A sample of cells from each

generation was used to isolate RNA for the presence of B2AR mRNA using Reverse Transcription with Polymerase Chain Reaction. Results are currently being analyzed.

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## **APPLYING SCIENCE TO SOCIETY**

### Presenter:

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### Mentor:

Dr. Lawrence Votta, President, Brincos Inc. 847-306-4760; quercus@mail.netwave.net

How do we, as a society, invest in science? What is the most effective way to support scientific research so that it can do the most to improve the quality of life for society? Does this differ from the way providing the most scientific knowledge? These questions will be addressed in the context of Dava Sobel's book, *Longitude*. Specifics of the great longitude problem, including the chronometer and astronomical solutions, will be addressed in order to gain a clearer understanding of the forces that motivate scientific research and what that means for us today.

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## **DEVELOPING AN ALGORITHM FOR TRANSITION GAITS: CHANGING FROM ONE WAVE GAIT TO ANOTHER**

### Presenters:

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### Mentor:

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When dealing with the problem of traversing rough terrain, wheeled vehicles have generally been preferred. However, there are some types of terrain which are too rugged or too steep for these vehicles. In these cases, a legged vehicle is preferred. The first step in emulating the motions of a legged creature is to observe the creature itself. After observing the gaits of various creatures in nature, the motion of the legs can be expressed as a series of equations. To this end, it has been found that the wave gait is the most stable gait. One problem that has arisen has been the development of an algorithm that accurately describes the transition from one gait to another. Of particular interest is the transition from one wave gait to another while maintaining stability and a constant velocity for the vehicle. It is hoped that once an algorithm is developed for this situation, another may be derived from it that describes all gait transitions. With an algorithm to describe the way things move, time is the only barrier to traversing all terrain effectively.

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## **INSIDE THE CRIMINAL MIND: A STATISTICAL ANALYSIS OF CRIME IN THE UNITED STATES**

### Presenter:

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### Advisor:

Dr. John C. Sippy, Social Science Department, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, Illinois 60506; sippy@imsa.edu

Sociology looks at what causes a criminal to commit a crime. It studies the criminal looking for reasons why a person commits a crime, and whether or not it is just human nature. By analyzing crime statistics, one is able to see how different variables affect different crime. More specifically, one can determine what possibly affects the criminal's decision to commit a crime. The results of this analysis will be discussed, as well as crime's affect on the general populous.

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## **THE EFFECTS OF TESTOSTERONE ON NITRIC OXIDE SYNTHASE EXPRESSION IN ADULT LABORATORY RAT BRAINS**

### Presenter:

Dan Murariu, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

Robert Handa, Ph.D., Loyola University Medical Center

Nitric oxide synthase (NOS) is an enzyme which produces nitric oxide (NO), an inorganic gaseous neuronal messenger. NO has been found to be a regulator in many functions of the human body, including vasorelaxation, release of dopamine, penile erection, and aggression. Studies also suggest that NO might contribute to brain cell death in stroke and in neurodegenerative disorders such as Alzheimer's disease and Huntington's disease. NOS has been shown to be co-localized with NADPH-diaphorase. In order to determine the effect of the male hormone, testosterone, on the number of NO cells in various brain regions, male rats were either castrated or left intact. Previous studies in the hypothalamic nuclei suggest that reduction of the testosterone decrease the number of NOS-positive cells. Therefore, I hypothesized that testosterone would increase expression of NOS only in brain regions which contain both testosterone receptors and NOS. Thin sections of the experimental and control rat brains stained for NADPH-diaphorase. Cells that stained positively for NOS were counted in the cerebral cortex. Positive cells per cm<sup>2</sup> were then calculated and results from the two groups compared. The castrated rats had 3.8 cells/cm<sup>2</sup> (range 2.9 to 8.4) NOS-positive cells, while the intact rats had 4.5 cells/cm<sup>2</sup> (range 1.4 to 6.9). Hormonal effects on NOS expression may have implications for neuronal transmissions and cognitive function.

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## **FERMILAB PHYSICS EXHIBITS ON THE WORLD WIDE WEB**

### Presenter:

Vishesh Narayan, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506 USA;  
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### Mentor:

Elizabeth Quigg, Computing Division, Fermi National Accelerator Laboratory, Batavia, IL 60510 USA;  
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The Leon M. Lederman Science Education Center at Fermilab is visited by students and teachers year-round to facilitate an understanding of concepts of physics through exhibits that demonstrate these concepts. This year, I worked to re-create these exhibits in forms that were presentable on the World Wide Web. One specific exhibit, titled "Race for Energy", demonstrated the concept of acceleration, and became my focus. The complexity of the project required that I implement the exhibit in a format known as a Shockwave movie, created in Macromedia's Director authoring environment. Once the user has run a few trials, he can examine the data gathered, and

generate a printable version of the results. One question was incorporated into the exhibit to test the user's understanding of the concept of acceleration, as well as a free-response section, which is not evaluated. Based on the number of trials and the user's answer, Einstein-bucks are awarded in the format of a check. Although some difficulties were encountered, most were circumvented without any perceptible change in the functionality of the exhibit.

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## **ARTERIAL BLOOD PRESSURE DURING SLEEP IN ADULTS WITH UNTREATED OBSTRUCTIVE SLEEP APNEA AND SYSTEMIC HYPERTENSION**

### Presenter:

Radhika Narla, Illinois Mathematics and Science Academy, 1500 West Sullivan Rd., Aurora, IL 60506;  
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### Mentor:

Dr. Robert C. Basner, Center for Sleep and Ventilation Disorders, University of Illinois at Chicago, 840 South Wood Street, Chicago, 312-413-0503; rcbasner@uic.edu

Obstructive sleep Apnea (OSA) is a disorder that causes many people to be obstructed in their breathing repetitively during sleep. Arterial hypertension is a common complication associated with OSA; arterial blood pressure (BP) rises acutely during obstructive events. This study examined the BP of patients with untreated OSA already being treated for hypertension. We monitored the BP awake and during sleep in 9 supine adults (6 African-American and 3 non-African-American). An ambulatory blood pressure monitoring device was used to record the BP every 15 minutes prior to, during and just after sleep. All patients had OSA with a (mean+SE) apnea/hypopnea index of  $32 \pm 5$ . For all subjects, mean arterial BP (MAP), which was  $90 \pm 2$  mmHg awake prior to sleep, was significantly increased in the A.M. following sleep to  $107 \pm 5$  mmHg. MAP was also significantly increased during both NREM sleep ( $100 \pm 1$  mmHg) and REM sleep ( $97 \pm 2$  mmHg) compared to awake levels prior to sleep. These data suggest that BP may increase to clinically significant levels during sleep and awake following sleep in patients treated for hypertension but not receiving treatment for OSA. Thus, clinicians need to consider whether patients with hypertension also have OSA in order to control 24 hour BP.

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## **THE EFFECT OF GENDER AND PAIRING ON NEONATAL OUTCOMES IN CONCORDANT TWINS**

### Presenters:

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### Mentors:

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Dr. Debra Guinn, M.D., Assistant Professor, Department of Obstetrics & Gynecology, Loyola University Medical Center, Maywood, IL 60153; 708-216-6079; dguinn@luc.edu

It has been observed that there is an excess of premature males and that males have poorer outcomes than females with similar birthweights. Possible explanations include: males reach greater weights at earlier gestational periods, have an excess of androgens which may promote contractions, display an unknown genetic proclivity for prematurity, or have a predisposition for development of chorioamnionitis which can result in preterm birth. Our objective was to examine the role of infant gender and gender pairing in 182 concordant twin pairs admitted to our NICU between 1990-1998. We hypothesized that if male sex was an independent risk factor for prematurity that the presence of two males, i.e. a male-male twin pair, should result in the shortest pregnancies and thus the worst outcomes. The following major outcomes were examined: (GA) gestational age, (RDS) respiratory distress syndrome, (BPD) bronchopulmonary dysplasia, (IVH) intraventricular hemorrhage and (ROP) retinopathy of prematurity. We found an excess of males in our cohort. Male-male pairs were born at similar ages as the male-

female pairs. The female-female pairs were the oldest. Overall males had worse outcomes than females. Male/Male twin pairs had the highest rates of RDS, BPD, and ROP. Surprisingly, Males in Male/Female twin pairs had similar outcomes to their sisters, suggesting that the presence of female siblings could be protective for male siblings with respect to eye and lung development.

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## **PIG TO HUMAN XENOTRANSPLANTATION (HOW THE UNLIKELY HERO WILL SAVE MANKIND)**

### Presenters:

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About 40,000 Americans will not receive an organ transplant because organs are unavailable. Xenotransplantation is one solution. Porcine organs are the choice for xenografts due to the similarity in organ size and physiology between the pig and human and availability of pig organs. However, the alpha-Gal epitopes that exist on the porcine endothelial cells induce the human body to violently reject the graft. Natural xeno-reactive antibodies that exist in human blood bind to the alpha-Gal epitopes of the graft's endothelial cells. Complement proteins are then fixed and activated, resulting in cell lysis, thrombosis, and ischemia of the organ. We examined prevention of hyper-acute rejection (HAR) using avian antibodies and complement inhibitors. To prevent the interaction of the human immunoglobulin with porcine organs, the grafts are coated with avian antibodies directed to the alpha-Gal epitopes. The avian antibodies possess a higher affinity for alpha-Gal epitopes, prevent human antibodies from binding, and eliminate what is essential for the activation of HAR. To prevent complement activation, a diatomic compound was developed to bind to and aggregate C1 to block complement-mediated lysis and antibody dependent cell-mediated lysis of pig endothelial cells. A small animal xenotransplantation model was used to assess effectiveness in prolonging graft survival.

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## **THE PHILISOPHICAL RAMIFICATIONS OF ARTIFICIAL INTELLIGENCE**

### Presenters:

Michael Olson, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

Jill Sison, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

Mike Osofsky, Applied Computer Technology, Inc., 69 South LaSalle Street, Aurora, Illinois 60505

This mentorship involves the reading and discussion of three books: The Mind's I and Fluid Concepts and Creative Analogies, by Douglas Hofstadter as well as The Symbolic Species, by Terrence W. Deacon. The Minds I is a collection of short stories and essays by various authors. Most of the stories are centered on the idea of consciousness and the individual. Is the "I" that acts and thinks a spiritual being, a soul, or is it an emergent phenomenon, a by-product of evolution? Fluid Concepts and Creative Analogies concerns the first efforts to create a true artificial intelligence by the *Fluid Analogies Research Group*, concentrating on their belief that the ability to make analogies is the base of intelligence. This covers their efforts from *Seek-Whence*, which guessed

the pattern in a series of numbers, to *Letter Spirit*, which attempts to form a complete gridfont alphabet from a given letter. The last book, *The Symbolic Species*, is mainly about how the brain and human language co-evolved. What is it about the human brain that makes language use and the ability to learn symbolically with relative ease unique to us? The main topic of our discussions was the idea of artificial intelligence and how it relates to these three books. How does one define the "individual" and "consciousness?" Is artificial intelligence merely a possibility or is it in the course of evolution that it will occur? What constitutes artificial intelligence, and how could we test a program for it? These are just some of the questions we sought to answer in our mentorship.

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## ***dek* ONCOGENE FUNCTION IN HUMAN BRAIN TUMORS**

### Presenter:

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### Mentors

Roger A. Kroes, Ph.D., Chief Molecular Neuro-Oncology, Chicago Institute of Neurosurgery and Neuroresearch,  
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Gliomas are among the most malignant brain tumors. They proliferate very rapidly and are highly invasive. There is no effective treatment for high-grade gliomas: patients usually die within a year from diagnosis. Many genetic alterations have been described in gliomas. The identification of differentially expressed genes between tumors and normal brain tissue will help us to understand tumor formation and to design effective treatments. Differential Display Reverse Transcriptase - PCR (DDRT), a procedure to identify these differentially expressed genes, was used and a panel of such genes was isolated, one of which encodes the *dek* oncogene. The primary goal of this project is determine the functions of *dek* in gliomas. A bacteriophage- $\lambda$  clone was isolated from a brain cDNA library that contains the sequences encoding the *dek* oncogene. *pfu*-PCR was used to amplify this defined coding region and Northern analysis was used to confirm that the correct region was amplified. The region was subcloned into an expression vector in both sense and antisense orientations. Once the expression vectors containing the *dek* gene were isolated, amplified, and purified, they were individually transfected into U373MG, a malignant glioma cell line. The cells were transfected with both the sense and antisense vectors to create separate populations of clones differing in amount of *dek* protein. Those which demonstrate significant changes in *dek* levels will be chosen for further study. Changes in proliferation, morphology, and invasivity will be assessed in these clones to characterize how *dek* functions.

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## **PHYSICS AND MATERIALS OF SUPER-SIDECUT SKIS**

### Presenter:

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### Mentors

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Michael Lindenmeyer, Grainger Lab Coordinator, Illinois Mathematics and Science Academy, 1500 W. Sullivan  
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There has been a recent technological revolution taking place in the downhill ski market. Super-sidecuts, skis with parabolic or arced indents along their edges, are replacing conventional straight skis in larger and larger quantities every year. The new skis combine wide tips, narrow waists, and wide tails to give them their hourglass shape. These alterations make it much easier for a recreational skier to carve a turn. I have been investigating the mathematics and physics of this technology to try and logically explain how the new shapes improve a ski's turning ability. I have also been working with the materials from which the skis are constructed. Composites and



metal alloys are out-selling the old style wood and fiberglass skis on the market as well. I specifically have been looking at the carbon fiber reinforced composite material that has become popular with many consumers and companies. The ideal qualities of a material involve some degree of vertical flexibility, but strong torsional stability. I have been experimenting to discern a relationship between the patterns of pre-preg composite layout and the aforementioned torsional strength.

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## **MONITORING OF THE ANTI-PLATELET EFFECTS OF NEW DRUGS FOR THE MANAGEMENT OF ACUTE MYOCARDIAL INFARCTION**

### Presenters:

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### Mentors:

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Thrombosis, the formation of disease-causing blood clots, is one of the most significant health problems in the world today. In the case of acute myocardial infarction, or sudden heart attack, the attachment of thrombocytes to the occluded coronary artery causes it to rupture. Injury to the vascular surface damages endothelial cells and exposes endothelial collagen. Platelets then quickly adhere to the collagen and become activated. In other words, platelets change in shape, releasing chemicals such as adenosine diphosphate, thromboxane A<sub>2</sub>, and serotonin and exposing 50,000 glycoprotein IIb/IIIa receptors. Simultaneously, tissue factors are released, combining with platelet factors to initiate the plasma coagulation cascade. Ultimately, fibrin is formed, serving to bind and anchor the aggregated platelets. The consolidated platelet-fibrin clot forms a permanent plug which seals the hole in the vessel wall. This clot must be disintegrated and its growth must be arrested to relieve chest pain and other problems associated with heart attack. Recently, several inhibitors of GP IIb/IIIa receptors have been introduced. Many drugs, such as ReoPro, Aggrastat, and Integrelin, have become available, while others, like the medium-duration inhibitor SR121566A, are still in the process of development. In the current studies, a comparison of this new drug was made with ReoPro, Aggrastat, and Integrelin.

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## **CYTOPLASMIC MOTORS IN KARTAGENER SYNDROME FIBROBLASTS**

### Presenters:

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### Mentor:

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Kartagener's Syndrome is a condition in which cells lack ciliary dynein, a protein required for ciliary motility. The purpose of this research is to determine the occurrence and distribution of the dynein, kinesin and myosin cytoplasmic motor proteins in five normal (CT) and four Kartagener (KS) non-ciliated cell lines using immunofluorescence microscopy. The cells were permeabilized by adding 0.02% saponin (for dyneins and kinesin) or acetone (for myosin) and then fixed using formaldehyde to preserve the structure of the cells. To block the resulting charged or reactive molecules, bovine serum albumin in phosphate buffered saline (1% BSA in PBS) was added. Cells were then incubated for an hour in a primary antibody directed against one of the motor

proteins, washed, and then incubated for an additional hour in a secondary fluorescein-labeled antibody. The samples were then observed in a fluorescence microscope using fluorescein optics. Dynein heavy and intermediate chain were seen as punctate cytoplasmic staining especially in the perinuclear region in CT and KS cells and as fibrillar fluorescence in KS cells. Kinesin was seen as strong fibrillar fluorescence with diffuse cytoplasmic staining in CT and KS cells. Myosin stained cells showed perinuclear foci and stress fiber patterns which were particularly distinct in KS cells. Our data show that dynein, kinesin, and myosin are present in CT and KS fibroblasts and that the staining patterns for dynein and kinesin differ for CT and KS cells. These differences may contribute in the motility defect known in KS cells.

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## **TRANSMISSION ELECTRON MICROSCOPY: THE ROUTE TO AN ATOMIC SCALE UNDERSTANDING OF ELECTRONIC MATERIALS AND DEVICES**

### Presenter:

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### Mentor:

Nigel D. Browning, Ph.D., Assistant Professor, University of Illinois at Chicago, Department of Physics, Chicago, IL 60607-7059, USA; 312-413-8164; browning@uic.edu

The major trend of technology over the last 20 years has been towards further and further miniaturization. Everything from hand held computers to pocket size Game Boys, people always want smaller and smaller items. In fact, technology has progressed so far that electronic devices are now being constructed on the smallest scale known, the atomic level. The only way for this trend to continue is through a fundamental understanding of how the atoms combine to give the desired performance of the electronic device. As light microscopes do not even come close to being able to see materials on the atomic level, transmission electron microscopes (TEMs) must be used to accomplish this feat. The use of electrons instead of light in these microscopes allows for extremely high magnification images to be obtained and individual atoms to be resolved. In addition, performing spectroscopy and electron diffraction allows the structure, composition and bonding in the device to be identified. This research described here will focus primarily on the operation and advantages of the TEM, and its potential uses in the future. In particular, the application of the techniques to understanding the electronic devices that will shape the start of the next millennium will be discussed.

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## **CALIBRATION OF FORCE BALANCE WITH TURBOMIN t<sub>n</sub>75 TURBOJET ENGINE**

### Presenters:

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### Mentor:

Dr. David Williams, Professor Mechanical and Aerospace Engineering Department, Illinois Institute of Technology, Chicago, IL 60616-3793; 312-567-3192; williams@mmae.iit.edu

The objective of the laboratory is to provide a working jet engine for undergraduates in the aerospace propulsion course. This requires installation and calibration of a thrust-measuring force balance and fuel weight balance, which are connected to its fuel tank. Proper restructuring of the engine arrangement setup (i.e. fuel tank positioning, platform restructuring, etc.) were first made. Measurements are being taken, comparing the thrust of the engine with the rate of fuel consumption. Labview (Windows software program) was used as an aide to acquire data from the various sensors on the engine. Additional effort will be made to improve the sensitivity of the fuel control apparatus (throttle). This is now controlled using a simple variable resistor. Final objective is to enable easy control of the engine and its measuring equipment to rapid data acquisition by students in the Aerospace propulsion class.

## **RUNNING REPORTS FROM ORACLE DATABASES FOR DISPLAY ON WWW PAGES**

### Presenter:

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### Mentors:

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Fermilab's Computing Division uses an extensive collection of databases to store information on equipment, purchase orders, network configurations and other data relevant to the Laboratory. Finding new, more efficient, and user-friendly ways to display this data to the Fermilab computing system users is always a top priority. Displaying data on the World Wide Web has always been an attractive option, but a few problems exist with current implementations. Some of these problems will be discussed, with emphasis placed on a couple of working techniques to more effectively provide data through the web.

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## **END OF LIFE CARE FOR NEONATES**

### Presenter:

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### Mentor:

Denise Angst, DNSc., Lutheran General Hospital, 1775 Dempster Street, Park Ridge Illinois 60068

As ethical issues over end of life care arise, the necessity for a clear understanding of neonatal palliative care is increased. Due to the patients' age and condition, neonatal end of life care is not well defined, nor has it been thoroughly examined. This study attempted to ascertain the quality and type of care given to critically ill neonates before their death. It also considered which support services were offered to the parents of these patients. The purpose of this study was to retrospectively evaluate all deaths that occurred in the Newborn Intensive Care Unit (NICU) in 1997 in order to determine what neonatal end of life care consists of and when palliative care measures are adopted. The sample consisted of the 28 neonates who died while under the care of the NICU at Lutheran General Hospital in 1997. Data was collected through a retrospective chart review using a common data collection form. Analysis of the data was descriptive and thematic. The primary areas of concern were: Background and Chart Information, Do Not Resuscitate/ No CPR orders, Palliative Care Practices, Management of Pain and Distress, Family Conferences, and Family Coping.

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## **RAPID PROTOTYPING: ROAD CONSISTENCY ANALYSIS**

### Presenter:

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### Mentor:

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Rapid prototyping with ABS plastic requires the deposition of molten ABS in strands called 'roads.' The quality of the final model begins with the accuracy and consistency of these roads. Single roads were analyzed with computer controlled microscope assistance for flow volume calculation. Then it was determined how accurately this flow volume could be changed. The basic question is how well the machine turns instructions into actual roads. Once it is determined how accurately the machine creates single roads, the programming of the machine can be altered to account for the behavior of the ABS. This is a follow-up and extension of grad-student work previously done at UIC.

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## **FABRICATION OF POROUS STRUCTURES USING LAYERED MANUFACTURING**

### Presenter:

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### Mentors:

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Merve Erdal, Assistant Professor, Department of Mechanical Engineering, Institute of Technology, 111 Church Street S.E. Minneapolis, MN 55455-0111; 612-626-7236; merdal@me.umn.edu

This research involves the fabrication of porous structures using layered manufacturing (LM) processes based on fused deposition (FD). The main focus of my research is the generation of components with controlled porosity, which are tested to determine dry and wet permeabilities. The purpose of this research is to learn how to generate configurations that can be used as preforms for advanced material systems with specific applications and to manufacture ceramic filter elements for high temperature environments. At the present time, there is no technology to generate porous domains with active control of the microstructure and pore architecture. The FD process has allowed me to be able to generate pore configurations and implement property gradients in order to meet the desired performance specifications. This experimental investigation will further allow for the development of proper correlation's and empirical models for the permeability's and microstructure and fiber architecture.

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## **PROTEIN PHOSPHATASE-2A AFFECTS TUMOR CELL METASTASIS**

### Presenter:

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### Mentors:

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Jeremy Meisinger, Laboratory Technician, Research Service (151-Z2), Hines VA Hospital, Hines, Illinois, 60141

Metastasis is the movement of tumor cells from a primary site to other parts of the body. The first step in metastasis is the migration of tumor cells through the surrounding extracellular matrix (ECM). This migration is dependent upon the flexibility and organization of the cytoskeleton, which control the cells' adherence to the ECM and the cells' motility through it. Capillary tube cell migrations were performed on metastatic (LN7) and non-

metastatic (C8) lung cancer cells, using chemical agents of varying concentrations that either stimulated (ceramide, retinoic acid) or inhibited (okadaic acid) the activity of protein phosphatase 2-A (PP-2A). We suspect that this enzyme is responsible for the dephosphorylation of the cytoskeletal proteins. Image-Pro imaging software was used to measure the surface area of cellular migration in order to determine the effect of PP-2A on tumor motility. The results of this study suggest that treatment with ceramide or retinoic acid to increase PP-2A reduced the metastatic character of tumor cells. In contrast, treatment with okadaic acid to decrease PP-2A production increased the tumor cell metastasis. The results of this study demonstrate the importance of PP-2A in limiting the capacity of tumor cells to disseminate, and may become the foundation for future studies that will target PP-2A as a means to block metastatic spread of tumors.

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## **THE EFFECTS OF VITAMIN D ON BRAIN MICROGLIA**

### Presenter:

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Dr. Margaret Prechel, Research Service, Hines VA Hospital, Hines, Illinois 60141; 708-343-7200

Microglia, the immune cells in the brain, when overactivated, are associated with the progression of neurodegenerative diseases, such as Alzheimer's disease. It is known from earlier research that Vitamin D can suppress the activation state of macrophages, and that microglia and macrophage cells are closely related. This study was undertaken to determine whether Vitamin D could also suppress the activation level of microglia. Part of the experiment was done *in vivo*, by treating mice with Vitamin D and looking at their Mac-1 expression in sections of brain tissue as an indication of the activation of the microglia. We also used *in vitro* methods, incubating both macrophages and brain organ cultures with Vitamin D and then measuring the production of the inflammatory mediators, nitric oxide (NO) and interleukin-6 (IL-6) in response to an activation signal. Interpretation of the results of these experiments will indicate whether Vitamin D could potentially be protective against neurodegenerative diseases.

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## **NITRIC OXIDE STIMULATION BY S100B WILDTYPE AND MUTANT PROTEINS IN BV-2 AND ASTROCYTE CELLS**

### Presenter:

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### Mentors:

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Dr. Tanya Petrova, Northwestern University Medical School, 303 E. Chicago, Chicago, IL 60611;  
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S100 $\beta$  is a protein found in excess quantities in the brains of people suffering from Alzheimer's disease. It is known to stimulate the production of significant amounts of nitric oxide in microglial cells. In large amounts, nitric oxide can be very damaging to neurons. We suspected that the C-terminal end of S100 $\beta$  might be responsible for its nitric oxide-inducing characteristic. So we created a mutant protein called S100 $\beta$  stop83, which was missing the last 8 amino acids from the 91 amino acid-long wild type. We then ran experiments to see if the mutant protein would stimulate less nitric oxide than the wild type would in BV-2 and astrocyte cells.

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## **HOW WAS VISUAL SURREALISM AFFECTED BY FREUD, GENDER ISSUES, AND TECHNOLOGY?**

### Presenter:

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### Advisor:

Robert Kiely, History Department, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, Illinois 60506 USA; 630-907-5977; oldstuff@imsa.edu

The causes of the surrealist art movement were investigated. Freud's explanations of dreams and the concept of the Id will be discussed, along with World War I and its affect on the image of the human. The woman's place in society also had a considerable affect on surrealism. The surrealist artwork of Jennifer Schneidman will be displayed. An explanation of how this Inquiry has affected her own artwork will be included in this presentation.

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## **DEVELOPMENT OF A PVDF FILM SENSOR FOR INFRASTRUCTURE MONITORING**

### Presenter:

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Development of a health monitoring system is of vital importance for all civil infrastructures. However, this effort has been stymied in part by the lack of suitable low-priced sensors and associated signal conditioning. Very often the requirement of a controlled stable power supply to the sensor itself poses another challenge. Piezoelectric polymer films offer an excellent alternative to the ubiquitous strain gage technology. The PVDF film generates an electrical charge when mechanically deformed. The PVDF film is typically a high impedance source with a capacitance in the nanofarad range. Consequently, measurement of low frequency events can pose yet another challenge. The authors have utilized a charge mode amplification scheme for measuring quasistatic processes. The processed signal can be transmitted to a data acquisition system via a RF microelectronic circuit. The PVDF film as a transducer can be cut to very small size (1.5x5 cm) and is very affordable at just 50 cents per sensor. The whole circuitry (sensing, signal conditioning, signal processing, and RF transmission element) can be integrated into one single unit. It would require very low power to function and could be embedded in the structure for a large number of remote applications. In this article the authors have reported the results of the various characterization tests that have been carried out to determine the suitability of the basic film as the core of an autodaptive sensor system to be designed for infrastructure monitoring.

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## **THE SLEEP APNEA SYNDROME: AUTOMATED ANALYSIS VS. VISUAL ANALYSIS**

### Presenter:

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### Mentor:

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Sleep apnea syndrome affects at least 3%-5% of the adult population in this country, causing significant morbidity and even mortality. The main obstacle for patients with sleep apnea syndrome has been daytime sleepiness. We are not certain of the cause of this symptom, but patients with sleep apnea syndrome experience numerous brief

arousals during their sleep, an effect which may interfere with the beneficial aspects of sleep. Quantifying these arousals has caused many challenges, partly due to the fact that visual analysis of arousals is imprecise. I have taken automated analysis, done by the computer, and compared it with visual analysis of arousals in polygraphic records of four women and four men with sleep apnea syndrome. Possible reasons for inconsistency between methods will be presented with actual data of visual and automated analysis.

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## **JAVASCRIPT AS A LEARNING AND TEACHING TOOL**

### Presenters:

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### Mentor:

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There are currently three javascript programs published on the web targeted to three different audiences. The first of these projects is a turbulent flow calculator. Using inputs such as viscosity and pipe size, this program determines which other aspects of the system are needed to ensure turbulent flow. The second project is a Toxic Equivalent Quantity (TEQ) calculator. This program uses the known amounts of dioxin congeners to determine the total toxicity of a mixture. The last and most in-depth project this year is an online units converter. This program contains several types of measurement (i.e. length, volume, mass, etc.). The converter is scheduled to be a part of a science education web site and contains historical educational information about the units as well as conversion.

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## **THE INTERNET AS A DEVICE FOR TEACHING AND LEARNING**

### Presenter:

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### Mentor:

Laura Mengel, Fermi National Accelerator Laboratory, 8E Wilson Hall, Batavia, IL 60510; lauran@fnal.gov

The Fermilab LInC program is designed to create a network of educational leaders who effectively use technology to support engaged learning. Throughout LInC's two-year history as a course offered online (a shift from the program's traditional face-to-face format), the LInC facilitators have developed better methods for encouraging engaged learning through online staff development. This year, research was done to gain a more complete --- but still rudimentary --- understanding of the issues associated with using the Internet as the primary means for communication and a method for accessing class materials. The research dealt specifically with strategies for conducting class sessions using IRC (Internet Relay Chat).

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## **WHERE DO THEY GO FROM HERE? LONGITUDINAL STUDY OF IMSA GRADUATES**

### Presenter:

Jay Thomas, Research Associate, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; 630-907-5990; jthomas@imsa.edu

The Illinois Mathematics and Science Academy's (IMSA) Longitudinal Study is a post high school study which attempts to highlight graduates' academic, professional, and personal pursuits, satisfaction with high school and college, academic preparedness, cognitive habits of mind, and civic responsibility. Graduates are contacted one year, four years, and seven after high school graduation and are asked to respond to a brief survey. Graduates'

responses are compared to responses of other high achieving students. After eight years of data collection, several trends have been identified: graduates have a higher percentage of math and science majors than college graduates nation wide; IMSA students are more satisfied with their high school experience than are comparison students, but comparison students rate their college academic experience more favorably than IMSA graduates; and IMSA graduates are very active in volunteer, civic improvement, peer tutoring, and campus government organizations. The survey instrument consists of twenty-six forced-choice and open-ended questions. Beginning with the college senior report for the Class of 1993 data are available from similar high achieving high school students from specialized mathematics and science high schools -- some of which are residential -- from around the nation. The National Consortium for Specialized Secondary Schools in Mathematics, Science, and Technology has joined the study and will use the same sampling technique, interview protocol, and survey instruments.

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## **RAMAN ANALYSIS OF MOTOROLA MACHINED SILICON**

### Presenter:

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### Mentor:

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It is currently known that Raman Microspectroscopy can be used for stress and phase analysis on silicon. That is, through inspection of a given Raman spectra, it is possible to gain information about the atomic structure of the sample. After running scans of the machined silicon provided by Motorola, analysis of Raman spectra has shown that when placed under extreme pressures (as in through machining processes), silicon will attain a ductile state, as evidenced in the material that squeezed out from the indentation. By inspecting the machined edge of silicon chips it is possible to determine the degree of transformation that has occurred. Maximization of these phase changes would allow for a significantly reduced damaged area that would require fewer processes to remove. Despite the progress that has been made with regards to this idea, much work remains to be done. Problems, such as determining the exact circumstances that lead to the formation of alternate phases of silicon, still need to be resolved. Furthermore, a more accurate deformation model must be provided which provides for the phase changes that have been shown to occur under an indentation. However, with the passing of time, we draw closer and closer to figuring yet another way of changing the way things work.

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## **ASSAYING THE EFFECTS OF FGF ON MOUSE EMBRYONIC STEM CELL DIFFERENTIATION TO MYOCARDIAL CELLS**

### Presenter:

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### Mentor:

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Annually, about one-half million Americans have heart attacks. 80% of these individuals survive, but they are affected by disorders caused by the dearth of heart cells. Embryonic stem cell-derived heart muscle has the potential to make replacement cells for heart attack victims. FGF is known to play a role in heart cell production in *Drosophila* and chickens. In mice our laboratory has found that FGF proteins and transgenes, which modulate the sensitivity of heart cells to FGF, provide a means of optimizing heart cell differentiation. Using immunocytochemistry techniques, I confirmed the expression of the transgenes Lac-Z, dominant negative, and



fibroblast growth factor FGF-R1, which control the "volume" at which the heart receives messages. I also used the techniques to determine when, where, and in what amounts heart cells are produced. Our lab has found that in a mouse model the addition of FGF protein in embryonic stem cell differentiation culture or of transgenic FGF receptor modifying transgenes 1) may be increasing the amount of heart cells produced, 2) can change the functional state of heart muscle, and 3) can change the rate of migration of cells that become heart cells.

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## **SERIATION AND CHRONOLOGY OF FIVE PUEBLO SITES IN THE NORTHERN RIO GRANDE AREA OF NEW MEXICO**

### Presenter:

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### Mentor:

Dr. Jonathan Haas, MacArthur Curator of North American Anthropology, Field Museum of Natural History, Chicago, Illinois 60605; 312-922-9410 ext. 641; haas@fmpr.fnmh.org

The potsherds excavated from five sites in the northern Rio Grande region of New Mexico were examined. These sherds were excavated from four to six test pits at each site; each pit was two meters by one meter, with fifteen centimeter levels. The attributes of the sherds examined include interior and exterior decoration, rimform types, color, and type of sherd (jar, bowl, rim, body). The seriations of these characteristics were compared to a previously established chronological sequence, in order to construct a more comprehensive sequence using more pottery attributes. This sequence will be presented, along with a brief explanation of the concepts of seriation and stratigraphy.

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## **QUALITY AND VALUE IN THE MARKETPLACE**

### Presenter:

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### Mentor:

Fred L. Fleischbein, President, Global Business Alliance, Inc., 445 W. Erie, Suite 109, Chicago, IL 60610;  
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In an age of such economic prosperity appreciated in the late twentieth century, many markets have become flooded with various groups all sharing the same goal. New companies arrive on an already crowded market of businesses competing for the attention of the consumer. Competition has risen to such a level as to include an emerging business philosophy of *quality management* in order to increase market-share. This practice raises some interesting questions about the nature of quality and its relationship to perceptions of the consumer on a given product. Included in this as well is the discussion of value and implied value, specifically in the determination the quality of a product. One would ask if the quality of a product were worth the price. My Mentorship research examines the importance of quality and value in our lives, creating a working definition of these terms and applying them to gain a better understanding of the way business works. I surveyed IMSA students on their perceptions of Quality and Value as they relate to the pizza industry in the Aurora area and interviewed pizza operators from restaurants IMSA students frequently purchased from. In a comparison of the various opinions a few interesting observations arose as to the characteristics of how IMSA students participate in the business world.

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## LEXICAL STEGANOGRAPHY – HIDING INFORMATION IN TEXT

### Presenter:

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### Advisor:

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Steganography provides for the embedding of information in a block of host data under conditions such that perceptible modification of the host data is intolerable. With steganography, you can put a hidden message in a digital picture or soundfile. Unfortunately, steganographic techniques are highly dependent on the character of the host data; a technique for embedding information in images might make subtle changes in hue, while a method for embedding information in audio data could exploit the limitations of the human ear by encoding the encapsulated information in inaudible frequency ranges. Current implementations of *textual* steganography (that is, hiding information in text) exploit tolerances in typesetting by making minute changes in line placement and kerning in order to encapsulate hidden information, making them vulnerable to simple retypesetting attacks. This project defines a framework for lexical steganography (based on synonym substitution) and discusses the details of an implementation. The project was submitted to the 1999 Intel (formerly Westinghouse) Science Talent Search.

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## SURFACE TENSION AND NITROGEN FLOW RATE ANALYSIS IN SOLDER JET TECHNOLOGY USING ISOPROPYL ALCOHOL

### Presenter:

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One limitation of the miniaturization of computer chips is the soldering process used to assemble the chip. An emerging soldering process, Solder Jet Technology, utilizes a print head based on ink-jet technology to dispense molten-solder droplets of 50 to 100 micrometer diameter on a substrate. This method, in contrast to the currently used methods of applying solder to computer chips, eliminates excess solder which lowers production cost and reduces the health risks associated with the handling of lead-based solder, and is very accurate, which allows for smaller chips. The solder jetting is normally conducted openly but with local environment control, which consists of a sheathing nitrogen ring flow surrounding the jet, to prevent a degradation of the surface tension when the solder reacts with oxygen. My research consisted of two parts, which pertain to the characterization of the dynamics of this technique. One aspect of my research was determining if the surface tension of the jetted liquid could be found by measuring the breakoff length of the jet and applying Weber's simplification of Lord Rayleigh's theory. Second, I attempted to determine the flow rate at which the nitrogen ring noticeably disrupted the flow of the jet.

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## **AUSCHWITZ MEDICINE: DR. ERNST B. & DR. JOSEF MENGELE**

### Presenter:

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This project explores the world of medicine during World War II, but more specifically, inside the Nazi concentration camp at Auschwitz. I have explored Nazi medicine through two Auschwitz doctors, Dr. Ernst B. and Dr. Josef Mengele, to examine who the physicians really were, the pseudo-medical practices that occurred, the psychology of genocide along with the history that led up to it, and the ramifications of their ideals and ideas.

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## **ANALYSIS OF THE SIMIAN VIRUS 40 GENOME IN HUMAN MESOTHELIAL CELLS**

### Presenter

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Simian Virus 40 (SV40) is a monkey virus that induces several tumors in rodents. It also transforms human cells in tissue culture. We have discovered that SV40 is present and biologically active in human mesothelioma. Mesotheliomas are tumors of the pleura, the membrane that surrounds the lungs. Several groups have confirmed our findings. To further investigate this link between SV40 and mesothelioma, we have infected primary cultures of human mesothelial cells with SV40. We discovered that human mesothelial cells are very susceptible to SV40 infection and that the rate of transformation in focus assays is much higher than the control. Using a technique called Southern Blotting Hybridization, we found a high percentage of episomal (not integrated) SV40 DNA in the host nucleus and a low percentage of integrated SV40 DNA at various host DNA sites. Presently, additional experiments are ongoing to elucidate these results. The data suggest that SV40 genome might exist in an episomal state in human mesothelioma cells.