
American Junior Academy of Science

11-15 February 1998
Philadelphia

Section editor, Gloria J. Takahashi

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1998 A J A S - N A A S PROGRAM
with the American Association for the Advancement of Science
Philadelphia Marriott Hotel and Pennsylvania Convention Center
Philadelphia, Pennsylvania Feb 11-15, 1998

**Hosted by the Pennsylvania Sr-Jr Academy of Science and Cabrini College*

Wed 2/11/98 American Junior Academy of Science (AJAS) & National Association of Academies of Science (NAAS) arrive in Philadelphia. Check into the Philadelphia Marriott Hotel, 1201 Market Street, Philadelphia, PA 19107. (215) 625-2900

4:00pm AJAS Committee meeting in AJAS Director's Executive Suite 1580, Marriott

5:30pm-7pm *Organizational Meeting* of the AJAS Committee, chaperones, sponsors, parents, and NAAS Board of Directors. Gloria J. Takahashi, AJAS Director (CA), Juan G. Rodriguez, NAAS President (KY) and AJAS Committee Members. Marriott, Grand Ballroom I & J

7pm-7:30pm **AJAS Registration**
 Distribution of registration & program materials, Badges, t-shirts, pins, etc. Collect late AJAS/NAAS fees. Kathy Gotshall (FL), Elemer Bernath (CO/WY), Ollin Drennan (MO), Stan Tracton (PA) and Cabrini College Students (Anthony Metz, Christine Ream, Elizabeth Morgan, Tara Gilpin)

7:30pm-10pm **AJAS/NAAS Orientation & Welcome Meeting**
 Introductions NAAS Board and AJAS Committee, Program changes, Ben Franklin Alive! Juan G. Rodriguez, NAAS Pres (KY) & GLORIA J. TAKAHASHI, AJAS Director (CA) AJAS Committee Members: Don Cottingham (VA), Peggy Tilgner (IA), Dave Weaner (OH) Howard Pitkow, Pres-PA Academy, Helen Ericson, Region-1 Director- PA JAS, Kate Gallagher, Science Teacher and PA Jr. Academy of Sciences, "Getting to Know You". Stan Tracton, PJAS Dir @ Lge Marriott, Grand Ballroom I & J
Surprise Ben Franklin visitation!

10pm-12am Students meet with chaperones to review proper conduct and prepare for tomorrow's AAAS 150th Anniversary Student Science Displays. Marriott, Grand Ballroom I & J

Th 2/12 AAAS Meeting begins. Breakfast & dinner on your own (OYO)

8am-4:30pm **NAAS BOARD MEETING** Marriott, Room 306

8:30am-3pm **VIP TOURS**
 Coordinators: Helen Ericson (PA), David Weaner (OH), Peggy Tilgner (IA), Ed Brogie (NE), Elemer Bernath (Co/Wy)

8:30am-11:00am Tour of Independence National Historic Park starting with Christ Church, Cabrini College Student Hosts (Tanya Battistini, Robt Thompson, Dana Nelson, Heidi Smith, Susan Hinchey) Divide into groups. Dress for snow, wind, rain or cold northeastern winter weather (br-rr-r). Meet at 12th Street entrance-east side of Marriott Hotel.

11:30am-3pm Bus Trip to the University of Pennsylvania Museum of Archaeology and Anthropology. Speaker: anthropologist Dr. Janet Monge, "Oh My Aching Back! Sack lunches will be provided. Or Two Legs: Big Problems"

Th 2/12 continues

*4:30pm-6:30pm **AAAS 150th Anniversary Student Science Convocation**

Coordinators: Don Cottingham (VA), Dean Decker (VA)

4:30pm-5:30pm prepare for the event-26 state representatives & 12 others to escort AAAS past presidents

5:30pm-6:30pm: One AJAS delegate selected from each State Academy will join science students supported from a UNISYS Pgm in Philadelphia area HS to have table displays of their posters prior to the Keynote Speaker. Marriott, Grand Ballroom E,F,G & H

6:30pm-8pm **AAAS Keynote Address: Dr. Dudley Herschbach**, Nobel Laureate Chemistry, Harvard University, "Ben Franklin's Scientific Amusements".
Marriott, Grand Ballroom E,F,G & H

8pm-10pm Dinner OYO with chaperoned groups.

9pm-12am AJAS Lounge, Coordinator: David Hsi (NM), Marriott, Room 502

Fri 2/13 Breakfast & lunch OYO

7am-11am AJAS ORAL PRESENTATIONS

(check the AAAS 1998 Program for the six concurrent Sessions and your assigned session. About 10min/presenter- 5+ presentors/hr, with breaks as designated by each Chairperson) Marriott Grand Ballroom C,D

Due to President Clinton's talk, last minute room changes were made.

(M308) Room C:	Chair: David Weaner (OH)
(M302) Room D:	Chair: Peggy Tilgner (IA)
(M407) Room I:	Chair: Kathryn Gotshall (FL)
(CC111A) Room J:	Chair: Ollin Drennan (MO)
(CC110A) Room K:	Chair: Ed Brogie (NE)
(M301) Room L:	Chair: Elemer Bernath (CO/WY)

12:30pm Special Convention Speaker, President William Clinton

1:00pm-1:45pm Attend AAAS Topical Lectures (refer to AAAS 1998 Program)

(8pm-10pm)12:30pm-3:30pm NAAS attends AAAS Section Y Meeting. Marriott, Room 306 (Marriott, Ballroom L)

3pm-5:00pm **AJAS POSTER SESSION** Convention Center, GRAND HALL (setup 2-3pm; display 3-5pm; dressy-business attire) All AJAS delegates will set up posters to share with meeting attendees and others. Coordinators: Carolyn Boyd, AAAS & Kathryn Gotshall

*5pm-5:45pm Time to walk around, observe and discuss each other's research.

6:30pm-11:30pm Bus to the Philadelphia Academy of Natural Science. Enjoy dinner and the museum's planned activities. (wear warm, casual attire)
Transportation Coordinators: Peggy Tilgner (IA), Ed Brogie (NE), Elemer Bernath (CO/WY), David Weaner (OH)

9pm-midnight AJAS Lounge, Marriott Room 502

Sat 2/14 Valentine's Day

8am-9:30am Breakfast with Scientists hosted by *The 3M Company*

AJAS students, PA JAS, and scientists. Convention Center, Room 108-A & B

Sat 2/14 continues

9:30am-11:30am **Youth Meets the Masters** especially for AJAS delegates, local high school students and "those still young at heart." Informal interaction with Ben Franklin and scientists, Eloy Rodriguez (Cornell Univ), Jenny Glusker (Fox Chase Cancer Research Center), AAAS Pres-elect, M.R.C Greenwood (Chancellor UC Santa Cruz).
Coordinator: Saul Krasner (CT) Convention Center, Room 108-A & B

12noon-6pm Lunch OYO. Choose from the following AAAS Activities:

2pm-2:45pm: Topical Lectures

3pm: Sessions begin

Noon-2pm: Exhibits and General Poster Sessions

12pm-3:45pm **NAAS/AAAS Workshop** Convention Center, Room 202-B,
Topic: Electronic Communication

Coordinators: Gene Kritsky, Past Pres (IN), Shirley Malcom (AAAS, EHR)

4pm-6pm NAAS Assembly of Delegates meeting. Convention Center, Room 202-B

6:30pm-7:30pm **AAAS President's Lecture:** Dr. Mildred S. Dresselhaus, Massachusetts Institute of Technology. Marriott, Grand Ballroom E & F

7:30pm-10pm **AJAS/NAAS Recognition Banquet**

George Shoffstall Speaker sponsored by the Pennsylvania Academy of Science:

Dr. Keith Thomson-"The Search for a Living Fossil"

award winning author of "The Living Fossil" and "The Beagle Record"

Coordinators: Gene Kritsky, Past Pres. NAAS (IN), Gloria J. Takahashi, (CA)

Pianist from the PAJAS

Marriott, Franklin Hall-4th floor

10:15pm-1am AJAS Dance: DJ Music - mix, mingle & party!

Marriott, Grand Ballroom A & B

Sun 2/15 Attend AAAS sessions or see the sights then travel home safely.

Hope you had A-JAS-sy time and you'll share your good fortune with others!

1997-98 AJAS COMMITTEE**1997-98 NAAS BOARD OF DIRECTORS**

Gloria J. Takahashi-Dir/Chair-California

Elemer Bernath-Colorado/Wyoming

Ed Brogie-Nebraska

Don Cottingham-Virginia

Dean Decker-Virginia

Ollin Drennan-Missouri

Kathy Gotshall-Florida

Edward Haynie-St. Louis

David Hsi-New Mexico

Saul Krasner-Connecticut

Judy Parker-Minnesota

Peggy Tilgner-Iowa

David Weaner-Ohio

Local AJAS Committee

Howard Pitkow

Helen Ericson

Juan G. Rodriguez-President, Kentucky

Gene Kritsky-Past President, Indiana

Judy Parker-President elect, Minnesota

Fred Brenner-Secretary, Pennsylvania

Ollin Drennan-Treasurer, Missouri

Gloria J. Takahashi-AJAS Director, California

Lynn Elfner-Archivist, Ohio

Leslie Lieberman-member @ large, Florida

Neil Berman-member @ large, Arizona

Claire Oswald-AAAS Council, Nebraska

Ertle Thompson-AAAS Council, Virginia

Don Jordan-Newsletter Editor, South Carolina

Shirley Malcom-AAAS, Education & Human Resources

Judy Kass-AAAS, Education & Human Resources

Jerry Bell-AAAS, Education & Human Resources

Final Revisions of Program based on President Clinton's arrival for the 1998-9 NAAS Handbook, Directory & Proceedings 7/18/99 to Barbara Walthall AAAS

**American Junior Academy of Science
Breakfast with Scientists
Philadelphia Convention Center
Philadelphia, Pennsylvania
February 14, 1998**

*A Program of the National Association of Academies of Science
Affiliate of the American Association for the Advancement of Science
Sponsored by 3M*

Program

Welcome and Introductions

Judith E. Parker
President-Elect, NAAS

Research and Careers

Scientists from universities, research institutes, and industries across the United States

Menu

Orange Juice
Apple Compote
Scrambled Eggs
Bacon
Hash Brown Potatoes
Breakfast Pastries
Coffee, Tea, Milk

Academies of Science Sponsoring AJAS Participants

Arkansas	Nebraska
California	New Hampshire/Vermont
Colorado/Wyoming	New Jersey
Florida	New Mexico
Georgia	New York
Illinois	North Carolina
Indiana	Ohio
Iowa	Oklahoma
Kentucky	Pennsylvania
Minnesota	South Carolina
Mississippi	St. Louis
Missouri	Texas
Montana	Virginia

Annual Recognition Banquet
National Association of Academies of Science and
American Junior Academy of Science

February 14, 1998

7:30 pm.— 10:00 pm

Philadelphia Marriott, Franklin Hall A 4th Floor

Dinner

Program Honoring Our Nation's Premier High School Research Students

JUAN G. RODRIGUEZ

Welcome

Introduction of Board Members and Guests

GENE KRITSKY

Introduction

*The George Shoffstall Speaker**

DR. KEITH THOMSON

Award winning author, "The Living Fossil & The Beagle Record"

"The Search for a Living Fossil"

GENE KRITSKY

NAAS Honorary Service Award

GLORIA J. TAKAHASHI

PEGGY TILGNER, IA Jr. Academy

Recognition of AJAS Delegates

Photo Session

"Dancing with DJ Music"

10:15 pm to 1 am

Grand Ballroom A & B

NAAS OFFICERS

President..... Juan Rodriguez, *Kentucky Academy*
 President-Elect..... Judy E. Parker, *Minnesota Academy*
 Past President..... Gene Kritsky, *Indiana Academy*
 Secretary..... Fred J. Brenner, *Pennsylvania Academy*
 Treasurer..... Ollin Drennan, *Missouri Academy*
 Director, AJAS..... Gloria J. Takahashi, *So. Calif. Academy*
 Archivist..... Lynn Elfner, *Ohio Academy*
 AAAS Council Delegates..... Claire Oswald, *Nebraska Acad.*, Ertle Thompson, *Virginia Acad.*
 AAAS Representatives..... Shirley Malcom, Jerry A. Bell, Judy Kass, *Washington, DC*

** Sponsored by the Pennsylvania Academy of Science*

AJAS ACTIVITIES

Director.....	Gloria J. Takahashi, <i>So. California</i>
AAAS 150th Anniversary Student Science Convocation.....	Michael Strauss, Carolyn Boyd, AAAS; Don Cottingham and Dean Decker, VA
Oral presentation Chairs.....	Elemer Bernath, <i>CO/WY</i> ; Ed Brogie, <i>NE</i> ; Ollin Drennan, <i>MO</i> ; Peggy Tilgner, <i>IA</i> ; Dave Weaner, <i>OH</i> ; Kathryn Gotshall, <i>FL</i>
Poster Presentations.....	Carolyn Boyd, AAAS; Kathryn Gotshall, <i>FL</i>
Breakfast With Scientists hosted by 3M.....	Judy E. Parker, <i>MN</i> ; Juan Rodriguez, <i>KY</i>
AAAS Youth Meets the Masters.....	Saul Krasner, <i>CT</i>
Trip Coordinators & Tour Leaders.....	Helen Ericson, <i>PA</i> ; David Weaner, <i>OH</i>
Transportation provided by Cabrini College & PA Academy	Peggy Tilgner, <i>IA</i> ; Ed Brogie, <i>NE</i> ; Elemer Bernath, <i>CO/WY</i> , Cabrini College Students
Registration.....	Kathryn Gotshall, <i>FL</i> ; Ollin Drennan, <i>MO</i> ; Elemer Bernath, <i>CO/WY</i> ; Cabrini College Students
Welcoming & Orientation.....	Don Cottingham, <i>VA</i> ; Peggy Tilgner, <i>IA</i> ; Dave Weaner, <i>OH</i> ; Helen Ericson & Pennsylvania Jr. Academy
Photographers & Photo Album.....	R. Dean Decker, 1985-91 AJAS Director, <i>VA</i> ; David Weaner, <i>OH</i>
Follow-up Surveys.....	Don Cottingham, <i>VA</i> ; Peggy Tilgner, <i>IA</i>
T-Shirts.....	Biographics, <i>CA</i>

Special thanks to the offices of the Southern California Academy of Sciences & La Habra School, Ollin Drennan, Kathryn Gotshall, and Harry Takahashi

OUR HEARTFELT GRATITUDE TO ALL OF OUR LOCAL COORDINATORS AND SPONSORS

A Very Special Thank You

SPONSOR

Pennsylvania Academy and Junior Academy of Science
 Howard Pitkow, Ph.D., President, PA Academy
 Helen Ericson, Region I Director, PA Junior Academy
 Cabrini College and Students
 Antoinette Iadarola, President, Cabrini College
 Penny Becht, Assistant to the President, Cabrini College

FOR SERVICES PROVIDED

University of Pennsylvania Museum of Archaeology & Anthropology
 Janet Monge, Ph.D., Anthropologist
 Gillian Wakely, Assistant Director of Education
 Philadelphia Museum of Natural Science
 Carlyn Nelson, Activities Coordinator

Dinner Menu

*A Selection of Fresh Baked Dinner Rolls
Butter and Margarine*

*Tossed Garden Salad
Peppercorn Dressing*

*Breast of Chicken Sicilian
Seared Breast of Chicken
Simmered with Pomodori Sauce and Fresh Basil
Garnished with Ricotta Salada
Chef's Selection of Vegetable Bouquetiere
Rice Pilaf*

Triple Chocolate Cake

*Fresh Brewed Coffee, Decaffeinated Coffee, Milk
And a Selection of Herbal Teas
Iced Tea*

PARTICIPANTS BY ACADEMY
1998 AJAS/NAAS/AAAS Conference
Philadelphia, PA

ARKANSAS

*NGUYEN, Freddy T.
 *SCHMIDT, Geoffrey R.
 *SHAH, Sapan S.
 EARLEYWINE, Gary
 HUFFORD, Gary

COLORADO-WYOMING

*WISOR, Scott L.
 *YOUNGBERG, James J. "Jake"
 BERNATH, Elemer

FLORIDA

*FLETCHER, Kelly
 *FLOREZ, Luz H.
 *ZEHNGEBOT, Corey A.
 FLETCHER, Elaine
 HARVEY, Joan
 GOTSHALL, Kathy

****GEORGIA**

*KAY, Kendrick Norris
 *KUMAR, Praneetha
 *MATHIS, Charles R.
 KUMAR, Uma M.
 EL-JOURBAGY, Morad

ILLINOIS

*ADAMCZYK, Peter
 *ADEBOJA, Abidemi
 *CHEUNG, Jimmy S.
 *COMERFORD, Julie
 *NIKODEM, Paul
 *REINCKE, Candi
 *TORRES, Andrew
 *TUNG, Derrick
 CONNOLLY, Peggy

INDIANA

*DUSCH, Morgan D.
 *STUCKEY, Nathan C.
 ANDERSON, Wm. "Tom", Jr.
 CALLAHAN, J. Merle

IOWA

*FASSBINDER, Carol A.
 *SCHILLER, Amanda R.
 *SCUFFHAM, Mark
 FASSBINDER, Kathy A.
 REEMTSMA, Walter Lee
 SCHILLER, Ernest L.
 TILGNER, Peggy J.

KENTUCKY

*GARLAND, Nick
 *MANNING, Mary Elizabeth
 PARROTT, Mary Ethel
 RODRIGUEZ, Juan G.
 RODRIGUEZ, Lorraine

MINNESOTA

*DURAND, David A.
 *HABINEK, Lianne A.
 KAFKA, Susan J.

MISSISSIPPI

*FRIEDMAN, Adam A.
 MESSER, Joan M.

MISSOURI

*BAYNES, Terry L.
 BAYNES, Roy D.
 DRENNAN, Ollin J.

MONTANA

*MOREY, Amanda A.

NEBRASKA

*CHARRON, Anna R.
 *GRIFFIN, Steve J.
 *LINDSAY, Cory E.
 *OLSON, Michael E.
 *RIBLETT, Cortny M.
 *ROGERS, Lindsay A.
 BROGIE, Ed
 ROGERS, John A.
 WILLIAMS, Judith L.

NEW HAMPSHIRE/VERMONT

*McTEAGUE, Shauna
 *SOKOLSKI, Katie Ann
 FALETRA, Peter P.
 FALETRA, Mrs. Peter

**Student Delegate*

***New Participant*

NEW JERSEY

*BYAR, Joanna "Annie" B.
*ISKANDER, Paul J.
*LEITNER, Tara S.
*MANFREDI, Lisa D.
*SLUSKY, Joanna S.
*SOFIELD, Clifford M.
*ZELNER, Jonathan L.
GADEGBEKU, Barbara A.

NEW MEXICO

*CHAWLA, Kanika
HSI, David C.

NEW YORK

*EINBOND, Julia
*HERSCHENHOUS, Nicole L.

NORTH CAROLINA

*BLAZICH Frank A., Jr.
*HERRING, Agen J.
*LI, Jennifer
*MEEKER, Emily M.
*OGUNRINDE, Gbemisola Anne
*PETRIE, Matthew G.
*QUICK, Erica C.
*THOMPSON, Charles E. III
*WILLIAMS, Anne M.
CUTLER, Josie B.
CUTLER, Kenneth A.
HERRING, Ametta J.
JOHNSON-THOMPSON, Marian
PETRIE, Glenn E.
QUICK, Gloria G.
WILLIAMS, Charles M.

OHIO

*BARKER, Michael S.
*BOS, Karen J.
*BOWDREN, Shannon Lee M.
*BRADLEY, Alyson D.
*JATANA, Kris
*TUTTLE, Steve E., Jr.
*WU, Eric M.
BOS, Philip
ELFNER, Lynn E.
REAMES, Spencer E.
WEANER, David M

OKLAHOMA

*BARNES, Amber D.
*BOGLE, Kevin D.
*MASON, LaChelle M.
*PARKER, Andria L.
*THOMPSON, Brian M.

CAST, Darlynn B.
DONOVAN, Kathleen M.
FERGUSON, Joe D.
NELSON, Edward N.

PENNSYLVANIA

*CHAUDRY, Imtiaz M.
*HUENERFAUTH, Matthew P.
*PATRICK, Lisa D.
*YIP, Jennifer S.
BRENNER, Fred
PANAH, Assad I.
PITKOW, Howard
YIP, Yee Ping Lucien

ST. LOUIS

*BOSUKU, Biongo
*WOODS, Danielle
*YOUNG, Roberto
HAYNIE, Edward C.
MURPHY, Charles
THOMPSON, Kenetia

SOUTH CAROLINA

*GOROD, Brianne Jenna
*McALILEY, James Patteson
MEARES, Charlotte
REEVES, Tom J.

SOUTHERN CALIFORNIA

*HO, Annamaria T.
*HWANG, Cindy H.
*McDONALD, Marin A.
*PIETRAS, Christopher J.
*TAO, Andrea R.
*WILLIAMS, Eleanor E.
*YI, Rena R.
NICHOLS, G. Duane
SAILOR, Michael J.
TAKAHASHI, Gloria J.
WILLIAMS, Leila K.

TEXAS

*BHATIA, Karan S.
*CHEN, Deborah M.
*HO, Bruce J.
*HOLWITT, Greg
*HOLWITT, Joel
*PHILLIPS, Michelle
*SPENCE, Elizabeth D.
*TRIVEDI, Shamita A.
*WITTEN, Emily A.
BOELTER, Donna B
PESTHY, Carolyn
PHILLIPS, Nancy B.

SHEPHERD, Karen J.
WITTEN, Eric B.
WOLFF, Kim

COTTINGHAM, Don
DECKER, R. Dean
STEWART, Susan H.

VIRGINIA

*AHMED, Salim H.
*HARMON, Jakob B.
*HUNDLEY, Travis W.
*KESSLER, Jessica D.
*MOSTAGHIMI, Arash
*SCHAFFNER, Rachael A.
*SHERALI, Azeem

102 Student Delegates
168 Total Delegates
26 Academies represented

State Junior Academy Presenters for Opening Convocation

February 12, 1998

4:30pm-6:30pm

Marriott Grand Ballroom

Arkansas

Geoff Schmidt

California

Annamarie Ho

Colorado

Jake Youngberg

Florida

Kelly Fletcher

Georgia

Charles Mathis

Iowa

Carol Fassbinder

Illinois

Andrew Torres

Indiana

Morgan Dusch

Kentucky

Nick Garland

Minnesota

Lianne Habinek

Mississippi

Adam Friedman

Nebraska

Corey Lindsay

New Jersey

Joanna Byar

New Mexico

Kanika Chawla

New York

Julia Einbond

North Carolina

Mathew Petrie

Ohio

Michael Barker

Oklahoma

Andrea Parker

Pennsylvania

Jennifer Yip

South Carolina

Brianne Gorod

Texas

Craig Holwitt

Virginia

Jakob Harmon

**American Junior Academy of Science
Delegates by Poster Session
1998**

Life Sciences

Peter Adamczyk
Abidemi Adeboja
Salim H. Ahmed
Michael S. Barker
Terry Baynes
Karan Bhatia
Frank A. Blazich, Jr.
Karen J. Bos
Shannan Lee M. Bowdren
Alyson D. Bradley
Annie Byar
Anna R. Charron
Imtiaz M. Chaudry
Jimmy S. Cheung, Jr.
David A. Durand
Morgan D. Dusch
Carol A. Fassbinder
Helen Florez
Adam A. L. Friedman
Brienne J. Gorod
Steve Griffin

Lianne A. Habinek
Agen Herring
Nicole L. Herschenhaus
Annamarie Ho
Bruce Ho
Greg Holwitt
Joel Holwitt
Travis Hundley
Cindy H. Hwang
Kris R. Jatana
Jessica D. Kessler
Praneetha Kumar
Tara Leitner
Jennifer Li
Cory R. Lindsay
Lisa Manfredi
LaChelle M. Mason
Marin McDonald
Shauna McTeague
Emily Meeker
Amanda A. Morey

Arash Mostaghimi
Lisa Patrick
Christopher J. Pietras
Candi Reincke
Cortny M. Riblett
Lindsay A. Rogers
Rachel A. Schaffner
Amanda Rae Schiller
Mark Scuffham
Sapan S. Shah
Azeem Sherali
Joanna Slusky
Clifford Sofield
Katie Sokolski
Charles Thompson III
Andrew M. Torres
Derrick K. Tung
Steven E. Tuttle
Anne Williams
Jennifer S. Yip
Corey Zehngebot

Physical Sciences

Kanika Chawla
Deborah Chen
Julie Comerford
Nick Garland
Jakob B. Harmon
Matthew Huernerfauth
Paul J. Iskander
Kendrick Norris Kay
Lisa Manning
Charles R. Mathis
Freddy T. Nguyen
Paul Nikoderm
Anne Orgunrinde
Andria Parker
Matthew G. Petrie

Michelle Phillips
Erica C. Quick
Geoff Schmidt
Elizabeth Spence
Nathan Stuckey
Andrea R. Tao
Eleanor Williams
Scott L. Wisor
Emily Witten
Danielle Woods
Rena Yi
Roberto Young
Jake Youngberg
Jonathan Zelner

Social Sciences

Amber D. Barnes
Biongo Bosuku
Julia Einbond
Brian M. Thompson
Eric M. Wu

Education

Kevin Bogle
Kelly Fletcher

**American Junior Academy of Science
Abstracts of Student Papers
presented at the Annual Meeting of the
American Association for the Advancement of Science
Philadelphia, PA**

1998

**Friday, February 13, 1998
Convention Center, 2nd Floor, Grand Hall
3:00-5:00 p.m.**

Life Sciences, 160
Physical Sciences, 172
Social Sciences, 177
Education, 178

Life Sciences

February 13, 1998 3:00-5:00pm

Ovarian Autoimmunity and Polycystic Ovary Syndrome (PCOS). PETER ADAMCZYK (Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506-1000) J. LUBROSKY, PhD., B. LLANES, P. McGOVERN, M.D., N. SANTORO, M.D., (Department of Obstetrics and Gynecology, Rush Medical College, 1653 W. Congress Parkway, Chicago, IL 60612)

Ovarian auto-immunity is frequently associated with premature menopause and infertility. It has also recently been suggested that a subgroup of Polycystic Ovary Syndrome (PCOS) possesses an auto-immune etiology. The objective of this research was to test the hypothesis that PCOS is associated with ovarian antibodies and elevated regulatory cytokines (IL-4, INF- γ). Ovarian antibodies were measured by an established ELISA immunoassay and cytokines were measured with a commercial immunoassay. Frequency levels for ovarian antibodies were found to be significantly different ($p < .0005$) in PCOS (28%) than in infertility (61%) and premature menopause (53%) but were similar to control and population (17%) values. Measurable cytokines were found in all categories but were more frequently elevated in PCO patients (62%) than in infertility patients (24%) or normal controls (35%-50%). These results indicate that PCO does not appear to be significantly associated with ovarian autoimmunity as determined by this immunoassay. Since cytokines, as markers of immune dysregulation were elevated, there is evidence for immune dysregulation in PCOS. The nature of this immune dysregulation remains to be determined.

A Comparative Study of Cytokines Involved in B-Lymphopoiesis in Aged and Young Mice. ABIDEMI ADEBOJA (Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506-1000) Dr. PAMELA WITTE (Department of Cell Biology Neurobiology and Anatomy, Loyola University Medical Center, 2160 South First Avenue, Maywood, IL 60153)

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.

The History of an American Elm: Oral Tradition and DNA Markers. MICHAEL S. BARKER (USDA-Forest Service, 359 Main Road, Delaware, Ohio 43015)

Within the nursery industry and the Dutch elm disease research community, an American elm, *Ulmus americana*, cultivar

known as the 'Princeton elm' has been rumored for many years to harbor a high tolerance to the Dutch elm disease pathogen, *Ophiostoma ulmi*. The tree was selected in the early 1920's for its excellent shape and growth, and in the early 1930's twenty supposed 'Princeton Elms' were planted along Washington Road, just outside of Princeton, New Jersey. The trees have survived two pandemics of Dutch elm disease with a 94% survival rate (the 6% mortality rate also represents automobile accidents and storm damage). The research involved the determination of the phylogenetic relationships among 12 of the Washington Road American elms to a possible 'Princeton Elm'. DNA was isolated from leaf samples of each tree via a hot-CTAB extraction method. The DNA was then amplified using the R.A.P.D. (Randomly Amplified Polymorphic DNA) P.C.R. (Polymerase Chain Reaction) method. Polymorphisms were scored and entered into the phylogenetic tree construction program RAPDistance v.1.04. Some of the Washington Road American Elms were found to be genetically identical. This would coincide with the oral tradition that the DED-tolerant Washington Road American elms are clones of the Princeton Elm.

The Alternatively Spliced Erythropoietin Receptor: Expression in E. coli and Purification of the Recombinant Protein. TERRY BAYNES (Pembroke Hill School, Kansas City, MO) Dr. ROY BAYNES (University of Kansas Medical Center, Department of Hematology, Kansas City, KS)

Erythropoietin stimulates red blood cell maturation and prevents programmed cell death by binding to receptors located on these cells. The erythropoietin receptor (EPOR) undergoes alternate RNA splicing to produce a truncated form of the receptor which could regulate the hormone's effects on red cell production. I have previously shown that this RNA expressed in a mammalian system produced a secreted form of the receptor. In order to perform biochemical studies which would evaluate the level at which the alternatively spliced EPOR could play a regulatory role, it was necessary to express the alternatively spliced EPOR in a less expensive bacterial system and to purify it. The first purification strategy involved engineering a stretch of 6 histidine residues at the carboxy-terminal end, thereby facilitating purification using a nickel-affinity column. For the second strategy, a specific epitope (FLAG), for which commercial antibodies exist, was engineered at the carboxy-terminal region, thereby allowing for immuno-affinity purification. The results of these studies revealed that both engineered sequences are successful in facilitating purification. A protein of greater than 95% purity is obtained after electroelution. The purified alternatively spliced EPOR will be used in binding studies to determine the functional significance of the AS-EPOR and to produce an antibody which can be used in developing an assay for the protein.

The Effects of Ultraviolet Light on the Growth of Spirogyra. KARAN BHATIA (Vines High School, Plano, TX), KIM WOLFF (Vines High School, Plano, TX)

Will *Spirogyra* grown under ultraviolet light for only four out of the total number of hours of sunlight per day have a more significant growth than *Spirogyra* grown with usual outdoor conditions of sunlight for the total number of hours of sunlight per day when grown in an aquarium for three weeks under the same temperatures and the amount of time exposed to any type

of light is held constant? In this experiment, the effect of ultraviolet light has on Spirogyra growth was tested. First, the materials were gathered. The materials needed were an ultraviolet lamp, six aquariums, thirty grams of semi-moist soil, six liters of distilled water, six jars of Spirogyra, a disposable spoon, and sunlight given off during the day. In two aquariums, one liter of distilled water was poured into each. Then five grams of semi-moist soil was added to each aquarium. The soil and the water were stirred together with the disposable spoon until most of the soil had dissolved in the water. Then each aquarium received one jar of Spirogyra to be grown in the aquarium. Each aquarium was then placed in an area where both aquariums received indirect sunlight during the course of the day. Over one aquarium ultraviolet light was shown for four hours a day during sunlight hours for three weeks. This was labeled as the variable experiment. The other aquarium received only sunlight throughout the day. This was the control experiment. Both aquariums were grown for three weeks and the amount of growth was determined by the mass increase of the Spirogyra. At this time two more trials were conducted using the same procedure. The results showed that the ultra-violet light disabled the growth of algae in two of the three variable experiments, and that sunlight helped the growth and development of Spirogyra in all three control experiments.

The Preferred Food of Tenebrio molitor. FRANK A. BLAZICH, JR. (William G. Enloe High School, Raleigh, NC)

When growing mealworms it was always said to use potato halves to feed the mealworms. Mealworms (*Tenebrio molitor*) were placed into two separate aquariums of equal representation and set up to support mealworms with halves of banana, apple, orange, and Irish potato placed in the corners of each aquarium. A total of 100 mealworms was placed in the middle of each aquarium. The experiment was conducted twice. Every day for a week the number of mealworms at each fruit or vegetable was counted and recorded. Banana had a consistently higher percentage of mealworms feeding on it, 20%. Even though orange and apple were close, 18% and 19.7% respectively, the daily percentages varied widely. The control (potato) was well below the fruits' percentages with 14%. Banana was shown as the preferred food of mealworms. Additional research is currently testing to determine if it is the best food on which to grow mealworms.

Influences on the Amphiphilic Phospholipid Bilayer of the Cell Membrane. KAREN J. BOS (Hudson High School, Hudson, Ohio)

The phospholipid bilayer is an important component of the membranes found in cells and many intracellular organelles. The amphiphilic molecules, often interspersed with a variety of proteins, orientate in a distinctive structure with the hydrophobic fatty acid chains between two layers of hydrophilic phosphate and nitrogen groups. The specific fatty acid chains account for the selective permeability of the membrane and are important in the degree of its curvature. Influences on the bilayer include temperature and osmotic conditions. In this project, experiments were designed to test the formation and existence of a phospholipid bilayer under varying conditions.

Aqueous Stream Bioremediation through Phytoextraction. SHANNON LEE MARIE BOWDREN (University of Cincinnati, Ohio 45221)

The potential use of manganese as a replacement for lead in gasoline formulation and its consequent potential as a future pollution hazard to aqueous streams warrant present research initiatives. Mercury, a heavy metal, which already contaminates many aqueous streams as a result of industrial pollution also

demands continued research to arrive at solutions for its efficient and safe removal. This study involved the transference of two terrestrial plant species, *Helianthus annuus* (Giant Greystripe Sunflower) and *Brassica rapa* (Mustard Tendergreen) into separate hydroponic nutrient mediums to remove up to 300mg per aqueous liter levels of manganese and up to 100mg per aqueous liter levels of mercury through their roots and shoots over designated periods of time. Comparison analysis of manganese and mercury recovery levels found in the ash of the roots and the ash of the shoots of the two plants was performed with an atomic absorption spectrophotometer. This was done to consider the alternate applications of harvesting the roots or harvesting the entire plant for the environmental cleanup of aqueous streams.

The Study of the Regeneration of Lumbriculus variegatus. ALYSON D. BRADLEY (Benjamin Logan High School, 6609 State Route 47, Bellefontaine, Ohio 43357)

There has been an increasing interest in using the aquatic Oligochaeta, *Lumbriculus variegatus* for the study of regeneration. *Lumbriculus variegatus* is a fresh water, segmented worm found throughout the world. *Lumbriculus variegatus* regenerate both anteriorly and posteriorly with segmentation occurring both in the wild and in lab conditions. Most of their respiration occurs on the ventral anterior side of the body, because of thinness of body wall. Their negative retactile responses is both forward as well as reverse with a coil swim through water. *Lumbriculus variegatus* was kept in four centimeters of a mixture of aged tap and distilled water. Worms were cut with a single edged razor blade between segments. Each of the pieces were kept in 1.5 ml micro-centrifuge tubes, and observed for regeneration every two to four days. Segments were counted and body length was recorded. Through this study it was found that *Lumbriculus variegatus* regenerate very well. The anterior end regenerates an eight segment head, and tail segments regenerate over 100 to 150 segments. This work has demonstrated that *Lumbriculus variegatus* may serve as an excellent model for the study of regeneration. It has laid the ground work for using *Lumbriculus variegatus* to study the molecular mechanisms associated with regeneration.

Green Clean: A Study to Maximize the Uptake of Toxic Metals from the Soil by Brassica juncea using EDTA. JOANNA BYAR (Byar Homeschool, Willingboro, NJ)

Phytoremediation uses hyper-accumulating plants to extract heavy metals from contaminated soil. Metals are extracted by the plant roots and translocated to the harvestable shoots for removal and disposal. However, many toxic metals in the soil are not available to the plant roots. Ethylenediaminetetraacetic acid (EDTA), a chelator, can solubilize the metals in the soil and increase plant accumulation. This study determined the timing and application rate of EDTA for maximum metal uptake. *Sassafras* sp soil was amended with six metals (Pb, Zn, Ni, Cd, Cu, and Cr⁶⁺) and seeded with *Brassica juncea*. Four experimental groups received differing amounts of EDTA over four weeks, totaling 5.0 mmol/Kg. The control group received only water. After four weeks shoots and roots were harvested, dried, and digested with acid for ICP analysis. Soil samples were also collected and analyzed for water soluble metals. EDTA applications increased the soluble soil metals (except Cr) substantially over the control. Higher metal uptake and accumulation by the plants with EDTA treatments was also observed. Those receiving later treatments exhibited the

greatest metal uptake. The shoot concentrations with EDTA were higher than the root concentrations, demonstrating that EDTA also assisted in the translocation of metals to the shoots. The application of a chelating agent like EDTA to the soil enhances the effectiveness of phytoremediation as a technique for remediating metal contaminated soils.

Effects of SIERRA Antifreeze on the Micropropagation of *Petunia Hybrida*. ANNA CHARRON (Central City High School, Central City, NE) JUDY WILLIAMS (Central City High School, Central City, NE) Dr. PAUL READ & ERIKA SZENDRAK (Department of Horticulture, University of Nebraska-Lincoln, Lincoln, NE)

What effects will different concentrations of "environmentally-safer" SIERRA antifreeze have on micropropagation of petunia? Past research has shown that SIERRA in concentrations higher than 1:50 have negative effects on seedlings in soil. Since the antifreeze mixed with the medium will have direct contact with leaf-cuttings, I hypothesized that all antifreeze-enhanced mediums will have negative effects on petunia micropropagation. Setup consisted of controls without hormones, controls with 0.2-BA solution of hormones, and variable concentrations. Concentrations added, to based medium were 1:2000, 1:400, 1:200, 1:100 and 1:50. I used a standard petunia procedure to sterilize and prepare petunia leaf-cuttings. I compared the rate of propagation of roots, shoots, and callus between each type of medium for 6 weeks. For analyzed data, I measured mass of individual leaf-pieces from each type of medium and compared the average mass of leaf-cuttings from freshly-picked leaves. There was not a major difference in petunia mass of the concentrations between 1:2000 and 1:100. Overall, antifreeze concentrations appeared to have more beneficial effects. The 1:50 medium was most harmful, because there was no propagation and it caused a distinct yellow discoloration. I concluded that concentrations stronger than 1:50 had destructive effects on petunia tissue when directly in contact with it, but concentrations weaker than 1:100 did not severely affect petunia tissue.

Effect of Soybean Isoflavone Concentrate on Human Immune Cells. JIMMY S. CHEUNG, JR. (Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506-1000) RAJABATHER KRISHNARAJ and MOHEPAL SINGH PORIA (Department of Medicine, (M/C 787), University of Illinois at Chicago, 840 South Wood Street #1 102, Chicago, IL)

Soybean extract is known to have several biological effects in humans and animals, both in vivo and in vitro. In order to understand the anti-carcinogenic effects of soybean, we tested Soybean Isoflavone Concentrate (SIC). SIC contains various types of isoflavones, including genistein, which may influence the growth of cancerous cells. In addition, some of the anti-cancer properties of isoflavones may be due to their ability to boost the immune system, which can normally destroy the cancerous cells. The SIC solution was tested on two human cell lines, NK cells and a leukemia cell line. We tested the acute effect of SIC on a human natural killer cell line in vitro. Since interferon gamma (IFN- γ) boosts immune system and plays an anticancer role, the production of IFN- γ was tested by immunofluorescence staining of NK cells followed by flow cytometric analysis. In preliminary experiments, incubation of NK cells with SIC resulted in a significant activation of these cells to produce the proinflammatory cytokine viz., IFN- γ . Further tests to evaluate if SIC has any other effects on the performance of the NK or leukemia cells are in progress. We conclude that the ability to induce the IFN- γ synthesis through

phytochemicals in functional foods may be advantageous in certain clinical situations.

An Observational and Statistical Analysis of the Effects of Manufactured Olestra on a Murine Population of *Mus musculus*. DAVID A. DURAND (Burnsville Senior High School, Burnsville, MN)

The purpose of this study was to determine the effects of adding Olestra, a fat-substitute manufactured by Procter and Gamble, to the diets of mice. Sixteen (16) mice were involved in the investigative study which lasted over a four-week period. The eight (8) *Mus musculus* of the experimental group consumed the manufactured Olestra in a 2:1 mixture of two (2) parts Olestra per one (1) part KAYTEE Forti-diet natural food. The eight (8) mice of the control group were given the same total mass of food as the experimental group in the form of the KAYTEE Forti-diet natural food. The mice were massed daily at a constant time and observations were recorded. Primarily, the average difference between the ending mass of the experimental group and the control group was 3.57 grams less than the ending mass of the control group (3.57 grams is approximately 22.31% of the average initial mass). Secondly, the Olestra diet produced several noticeable effects. Two (2) of the experimental group died (25% mortality). All eight (8) mice of the experimental group experienced anal leakage and diarrhea. They also had an unkempt, greasy appearance when qualitatively compared to the control group. By using t-score analysis, the results were verified and thus the null hypothesis must be void—proving a substantial difference between the results of the experimental and control groups.

The Effects of *Acarapis woodi* on *Apis mellifera*: Do Soybean Oil Patties Really Work? CAROL A. FASSBINDER (Valley Community High School, Elgin, IA)

Nationwide, *Acarapis woodi* continues to be a devastating parasite for *Apis mellifera* (honey bees). Are there possible benefits in having a longer lasting hydrogenated soybean oil patty in the hive as well as having a shorter lasting liquid soybean oil patty in the hive? Does the effect of these two patties together improve the survivability of the colony better than either patty alone? Do other factors, such as the *Varroa jacobsoni* contribute to the level of the *Acarapis woodi* and the survivability of the honeybee colony? 10 groups were chosen for the experiment. N=160 colonies. At the beginning of July, an *Acarapis woodi* test was performed before hydrogenated soybean oil patties were applied. During mid-July, hydrogenated soybean oil patties were applied to all colonies in groups 1, 2, 3, 6, 7, and 8. Groups 4, 5, 9, and 10 were not given any hydrogenated soybean oil patties. During the first part of September, another *Acarapis woodi* test was performed on all test colonies. Liquid soybean oil patties were then applied to all colonies in groups 4-8 during mid-September. Groups 1, 2, 3, 9, and 10 were not given a liquid soybean oil patty. A test was also performed at this time for the *Varroa jacobsoni*. All colonies were treated for the *Varroa* mite with fluvalinate strips during this time. During the last week of January, a third *Acarapis woodi*, *Varroa jacobsoni* and survival test was performed. One more *Acarapis woodi*, *Varroa jacobsoni*, and survival test was performed during mid-March. I conclude that there is a direct relationship between the presence of an oil patty in the hive, and the degree of *IP Acarapis woodi* infestation. Without some type of soybean oil patty in the hive, re-infestation appears inevitable.

A Correlative Study of Human Circadian Rhythms using Polysomnograph Sleep Studies. HELEN FLOREZ (Cooper City High School, Cooper City, FL) PAULINE COLLIER (Sleep Disorders Laboratory, North Broward Medical Center, Pompano Beach, FL)

The purpose of this year's research is to determine a correlation between circadian rhythms, body posture, stage of sleep, and nocturnal events through the analysis of nine polysomnograph sleep studies. The researcher believes that the majority of nocturnal events will occur between 3-4am, while on supine, and in stage II. The minority of nocturnal events will occur at 12am, while on right side, and in stage V (REM). Fifty-three percent of the apneas occurred in Stage II, 7% in REM, 39% in I and only 1% in III. Seventy-nine percent of apneas took place while supine, 16% on left, and 5% on right. Thirty-six percent of the hypopneas transpired in I and 32% in both II and V. Sixty-four percent of hypopneas occurred while supine, 25% on left, and 11% on right. Sixty-seven percent of leg movements transpired in II, 9% in REM, 21% in Stage I, and 3% in III. Regarding the leg movements, 33% befell while supine, 26% on left side, and 41% on right. People can benefit through this research by knowing which body posture apneas occur least in and CPAP machines can possibly be programmed to collaborate with circadian rhythms. Circadian rhythms were found to affect temperature which affects body posture which affects the occurrence of nocturnal events which finally affects the stage of sleep. In conclusion, a reduction of the amount of apneas may be obtained by controlling temperature and body posture.

Anti-Cancer Effect of Broccoli: Brassica Oleracea Selective Inhibition of Mammalian Cancer Cells and Mechanism of Action ADAM A. FRIEDMAN (St. Andrew's Episcopal School, Ridgeland, MS)

Broccoli extract has been shown to prevent neoplastic transformation by carcinogens in mammalian cells by inducing detoxification enzymes. This research hypothesized that broccoli could have other, therapeutic anti-cancer properties. Preliminary research in *Saccharomyces cerevisiae* suggested that a broccoli extract could partially counteract the growth-inhibiting effects of a extract from tobacco, possibly through induction of Adenylate cyclase (AC). Because increased AC activity has been shown to inhibit some mammalian cancers through the RAS growth pathway, it was hypothesized that the broccoli extract may inhibit the growth of mammalian cancer cells through induction of AC. To test whether broccoli could have these anticancer properties, the ability of a broccoli extract to inhibit the growth of three transformed mammalian cell lines was examined. The proliferation of MCF-7 human breast cancer cells, H-RAS-transformed MCF-7 cells, and v-RAS-transformed RAT I fibroblast cells was measured in the presence of the broccoli extract and also compared to the proliferation of non-transformed cultured human lymphocytes. Broccoli extract was found to inhibit significantly the growth of all three transformed cell lines in a dose-dependent form, whereas non-transformed human lymphocytes were found to be initially induced, and later only moderately inhibited. Comparison of the extract's effect on the three transformed cell lines suggested that RAS-transformed cells were more sensitive to inhibition by broccoli extract. To investigate the mechanism for these inhibitory effects, RAT I cells treated with broccoli extract were assayed for AC activity using a cAMP enzyme immunoassay. Broccoli was found to induce AC during the exponential growth of the RAT I cells; a mathematical analysis of this effect demonstrated that the inhibition of the growth of the cancer cells was due only in part to AC. In summary, these investigations identify broccoli as a specific

inhibitor of transformed cell growth, possibly through induction of AC, and suggests potential therapeutic properties of the extract for inhibition of certain cancers.

Evaluation of Techniques for Decreasing the Bacterial Load on Fecal Contaminated Venison. STEVE GRIFFIN (Adams Central High School, Hastings, NE)

Previously, research demonstrated home dehydrators did not effectively control bacterial growth on fecal contaminated venison. This year's project evaluated bacterial reduction techniques available to home venison process. Venison inter-rib meat sections were contaminated with deer feces. The contaminated inter-rib meat was randomly assigned to five sanitizing techniques: cleaned with 12.8 C H₂O (W), 82.2 C H₂O (H), 0.25% NACIO (B), 5% CH₃COOH (V), and steamed for 30 seconds (S). The procedure was replicated 20 times. The samples were cultured on MacConkey's coliform agar at 37 C. Colony count observations made at 12 and 24 hours showed only a numerical reduction (<2SD). The cleaning techniques were revised to: increase the steaming time to 1 minute (SS), steam for 30 seconds plus clean with 0.25% NACIO (SB), and clean with 82.2 C H₂O plus cleaned with 0.25% NACIO (HB). Eighteen randomly assigned contaminated samples were cleaned using the SS, SB, and HB techniques. The H, S, and B techniques were reevaluated. Evaluation was done as before. None of the techniques completely controlled contaminating bacteria. No difference (<2SD) in bacterial growth was found following cleaning with 12.8 C H₂O or 5% CH₃COOH (vinegar). There was a numerical reduction on samples cleaned with 82 C H₂O, 0.25% NACIO (diluted bleach), and steamed for 30 or 60 seconds, but the reduction was not statistically significant (2SD = p>.05). Cleaning with 82 C H₂O or steaming for 30 seconds, followed by cleaning with 0.25% NACIO statistically (2SD = p>.05) reduced the bacterial contamination when compared to C+ (positive controls).

Relationship Between Spinal Curvature and Bone Mineral Density in Women. LIANNE A. HABINEK (Mayo Senior High School, Rochester, MN)

It has been suggested that low bone mineral density (BMD) could be a contributing factor to or a side effect of spinal curves. The purpose of the present investigation was to determine if there is a relationship between BMD and spinal curvatures in a healthy adult female population. The DEXA scan records of 70 female subjects were reviewed. Each patient's age, weight, height, and total body, spine and lumbar BMD were recorded. Also, the lumbar curvature of each subject was measured manually by the experimenter using the Cobb method. Regression analyses were performed for Cobb angle with each of the other variables in the study. Although the trend in all cases was in the predicted direction, the correlation obtained did not strongly support the hypothesis of an inverse relationship between BMD and Cobb angle. Alternative explanations for the results are discussed.

The Effects of Free Radicals on Collagen. AGEN HERRING (Hillside High School, Durham, NC)

The purpose of this investigation is to determine if some of the differences in the cross-links between bone and skin collagen could be due to techniques used in the

preparation of bone collagen that produces free radicals. Free Radicals are produced by the Fe (II) H_2O_2 reaction in the presence of gelatin or reconstituted skin collagen fibrils. Very little thiobarbituric-reactive groups were produced with either protein. Most of the free amino groups in the collagen fibrils were eliminated. The free radicals known to be produced in bone during the milling of bone to a powder and those produced when EDTA binds Fe (III) during the decalcification process might account for some of the differences in the Schiff's base cross-links in the two collagens that have been reported.

A Phylogenetic Study of Three Novel Diatoms: Analysis of 18S rRNA Data and Assessment of Evolutionary Relationships.

NICOLE HERSCHENHOUS (Calhoun High School, 1786 State Street, Merrick, NY 11566)

Phytoplankton are autotrophic prokaryotes and eukaryotes that reside in the surface waters of the ocean and are responsible for a major part of the world's photosynthesis. In the 1995 IronEx II experiment, it was determined that they are iron limited in certain regions. When a high-nutrient, low chlorophyll (HNLC) patch of ocean was enriched with iron, a large phytoplankton bloom resulted. The species composition of the phytoplankton in the bloom changed, with diatoms (a type of eukaryotic phytoplankton) becoming the dominant group. Three new diatom isolates were cultured from the bloom which bore distinct morphological differences to the known species of diatoms. We are conducting a comparative study of these diatoms using an analysis of their 18S rRNA genes to determine their evolutionary relationship to the known diatoms.

Subcellular Localization of a Protein That Affects Integrin

Function. ANNAMARIE HO (La Jolla High School, La Jolla, CA 92037) DR. CSILLA FENCZIK and DR. MARK GINSBERG (Scripps Research Institute, La Jolla, CA 92037)

Components of the extracellular matrix play an important role in development and general maintenance of cell behavior. Integrins, a family of cell adhesion receptors, allow a linkage between components of the extracellular matrix and the cell interior. Cell adhesion can be regulated from inside the cell by modulating the affinity of the integrin for its ligand. This process is believed to be regulated by intracellular proteins. A genetic screen was performed to identify intracellular proteins that modulate integrin affinity. This screen identified a novel protein 5F8. We attempted to determine the subcellular localization of the 5F8 protein through immunofluorescence staining. In this procedure, cells were incubated with monoclonal antibodies raised against the 5F8 protein. A fluorescently labeled secondary antibody was used to recognize the primary antibody. Two series of staining were done; the first with mouse fibroblast cells and the second with Chinese hamster ovary cells that were transfected with human integrins and the human 5F8 protein. In conclusion, for both series of staining, (1) the staining of the primary antibody is specific, (2) the cells remain intact during staining, (3) the 5F8 protein does not appear to co-localize exclusively with integrins, and (4) the 5F8 protein appears to localize extensively on the surface of the cells. The last series of experiments were done to determine the localization of the 5F8 protein without its cytoplasmic domain. Previous experiments have shown that the 5F8 protein without its cytoplasmic domain does not function in regulating integrins. We have concluded that both the 5F8 protein and the 5F8 protein without its cytoplasmic domain localize to the surface of the cell, demonstrating that the cytoplasmic domain is not required for surface localization. (Supported by Research Training Program, Southern California Junior Academy of Science).

The Effects of Water Pollutants and Their Earth-Friendly Alternatives on Bean Plants. BRUCE J. HO (Churchill High

School, San Antonio, TX)

Water pollution is a serious problem that threatens everyone. Much of the water pollution in today's freshwater supplies is dumped by industries, but households cause a large portion too. Household water pollution is often the only pollution that people can directly affect. In order to attempt to find ways to limit household pollution a series of experiments were conducted to determine whether or not some chemical alternatives are effective environmental solutions. The "earth-friendly" alternatives were tested against their chemical counterparts. The effects were viewed through the growth and health of bean plants during three trials. Three chemicals were tested. They were chlorine bleach, drain unclogger, and a household cleaner. The alternatives were non-chlorine bleach, drain solution, and a household cleaning solution. Each plant received 100ml of water and a small amount of their pollutant that varied between the 3 trials. The controls received simply 100 ml of water every other day. The chemicals were chosen because of their frequent use in households. Many homes use some type of bleach in order to clean stains in clothing. The chlorine/non-chlorine bleach dilemma was addressed as part of the experiment. When drains are clogged, people in their homes, or plumbers often use chemicals. Drain chemicals are known to be toxic, and post various warnings on their labels. Certain household cleaners that are used to clean bathtubs, sinks, tiles, and other various things are used by homeowners, as well as cleaning workers. The chemicals and their alternative solutions were put to the test, in order to determine their effect on our green environment. If chemicals are damaging to plants, they are most likely unhealthy in the water and food supplies of humans. Most chemicals are better off not used when it comes to the environment, but perhaps alternatives can be used to cut down on pollution.

The Effect of Peroxynitrite on Repair Deficient

Bacteria. GREG HOLWITT (MacArthur High School, San Antonio, TX) DR./MAJOR ERIC HOLWITT (Biotechnology Branch, Radiofrequency Division, Occupational and Environmental Health Directorate, Armstrong Laboratory, Brooks Air Force Base)

Peroxynitrite has been shown to kill bacteria, but whether it kills by a genotoxic or nongenotoxic mechanism is unknown. Two bacterial strains were exposed to four different peroxynitrite concentrations at five different hydrogen ion concentrations or pHs to test if the bactericidal action of peroxynitrite is due to a genotoxic or nongenotoxic mechanism. One bacterial strain was a wild type and the other strain was BW535, which is deficient in three DNA repair enzymes. It was found that the effect of peroxynitrite was pH dependent, with peroxynitrite being much more lethal at pHs above 7 (basic) than below pH 7. Increasing the concentration of peroxynitrite reduced the percentage of cell survival. At three of the pHs tested, it was found that the repair deficient mutant, BW535, was more sensitive to peroxynitrite than the wild type. This implies that peroxynitrite kill bacteria by genotoxic mechanism.

Effect of Peroxynitrite on Deoxyribonucleosides.

JOEL HOLWITT (MacArthur High School, San Antonio, TX) Dr./Major ERIC HOLWITT (Biotechnology Branch, Radiofrequency Division, Occupational and Environmental Health Directorate, Armstrong Laboratory, Brooks Air Force Base)

This project was conducted to answer the question how reaction conditions effect the products formed by peroxynitrite.

Literature reports indicate that the presence of carbon dioxide leads to nitrated products, and the absence of carbon dioxide leads to hydroxylated and oxo products. Both types of products have been reported for the reaction between 2-deoxyguanosine and peroxynitrite in the literature, but the role of carbon dioxide was not clear. Furthermore, no reports of the other three nucleosides reacting with peroxynitrite were found. To resolve these questions, the various nucleosides of DNA were reacted with peroxynitrite in the presence and absence of carbon dioxide (carbonate was used in these experiments). With the analytical techniques available, this question remained unanswered. However to a first glance, the reaction conditions created different products, but no reaction condition was consistent in forming products. In fact, the nucleoside that was reacting seemed to determine which reaction condition gave the most products.

Do Your Cattle Really Need a Second Vaccination Against Leptospirosis? TRAVIS HUNDLEY (Carroll County High School, Hillsville, VA) Dr. JIM ADAMS (Carroll Veterinary Clinic)

The object of the experiment is to determine if cattle need a second vaccination against Leptospirosis. In the experiment 21 Holstein dairy cows were divided into 3 groups of 7 cows. The first day, blood was drawn from all 21 cows and groups 1 and 2 were vaccinated for Leptospirosis. Group 3 received no vaccination thus serving as the control group. Twenty-one days later, all cows were bled, and group 1 was re-vaccinated. At the 42nd day, all cattle were bled again. The blood samples were then taken to the State Diagnostic Lab in Wytheville, Virginia to analyze for a Leptospirosis titer. The first group maintained a higher amount of antibodies compared to group two, where their antibodies were slightly lower. The third group, the control, exhibited no increase over the six week time period. Any increase was considered to be negligent, due to natural encounters or possibly due to exposure to the Leptospirosis vaccine indirectly through the herd-mates. Therefore, the first group which received the recommended dosage maintained an adequate number of antibodies compared to the second group where the amount of antibodies decreased more rapidly. Future experimentation should retest the recommended dosage with increased numbers of cattle and could also test other vaccination schedules in addition to the ones considered in this study.

Characterization of Mutant *Saccharomyces cerevisiae* Cells with Diminished Activity of the First N-Glycosylation Gene, ALG7, Using Immunofluorescence Analyses. CINDY H. HWANG (Upland High School, Upland, CA) Dr. MARIA A. KLTKLTRUZINSKA and KELLEY L. LENNON (Department of Oral Biology and Biochemistry, Center for Advanced Biomedical Research, Boston University Medical Center, Boston, MA)

N-glycoproteins, necessary for cell-cell recognition, protein targeting, and malignant transformation, are synthesized via the dolichol pathway of N-glycosylation. The evolutionarily conserved ALG7 gene, key in controlling this pathway, is highly regulated and essential for viability. Deregulation of ALG7 in the yeast, *Saccharomyces cerevisiae* causes impaired response to cellular signals for cell cycle arrest and differentiation. Previous studies using flow cytometry to analyze the DNA content of mutant and wild type cells had suggested impairment in cell cycle checkpoints and abnormal DNA content for ALG7 mutants. Prior findings had also shown that deregulation of ALG7 interferes with sustained down regulation of BEM 1, a gene involved in actin cytoskeletal organization. To further characterize the effects of aberrant ALG7 expression, mutant yeast cells were observed and

compared to the wild type by fluorescence microscopy using stains specific for nuclear DNA, F-actin, and cell viability. Results confirmed that deregulation of ALG7 leads to abnormalities in cell cycle progression, namely cell cycle arrest, and cytoskeletal organization. [Partially funded by the Southern California Junior Science and Humanities Symposium.]

Role of the Ornithine Decarboxylase Gene in the Development of Head and Neck Cancer. KRIS JATANA (Ohio State University, Arthur G. James Cancer Hospital, Columbus, OH 43210)

The ornithine decarboxylase (ODC) gene plays a critical role in the cell cycle. ODC is the first and rate limiting enzyme in the synthesis of polyamines and is required for cells to progress through the cell cycle. This investigation measured the expression of ODC in human head and neck cancer cell lines and in normal human cells. The RNA was isolated from the cells and then a reverse transcriptase reaction was used to synthesize DNA. By using polymerase chain reaction (PCR), the ODC gene was amplified and the levels of this gene were measured. A statistically significant higher level of the ODC gene was found in head and neck cancer cells compared to normal cells; the t-test had a p-value of 0.0005. Future directions include testing wider varieties of cancer cells for ODC expression and investigating the role of ODC in the development of cancerous cells. ODC is possible target for therapeutic intervention.

Effects of Cruciferous Vegetables on Phase II Enzyme Levels and Corresponding mRNAs in Mouse Liver. JESSICA D. KESSLER (Mills E. Godwin High School, Richmond, VA)

Cancer is one of the leading causes of death in the U.S. and the attempt to stop the development of cancerous cells by using natural or synthetic chemicals is known as chemoprevention. Studies have shown that diets, which include cruciferous vegetables, may decrease the development of certain cancers by inducing Phase II enzymes in the liver. Phase II enzymes' chemopreventive activity is associated with the initiation stage of carcinogenesis. Earlier studies by this researcher indicated that leafy, green vegetables induced Phase II enzymes, therefore, mice were orally gavaged for 14 days with a broccoli, Brussels sprouts, or potatoes mash or oltipraz. Glutathione S-transferase enzyme levels in liver microsomes showed a pattern of induction identical to that of previous studies. Results of the mRNA studies are as follows: quinone reductase mRNA levels were so low as to be inconclusive; the UDP-glucuronosyltransferase showed only modest changes; however, glutathione S-transferase showed an increase in mRNA levels which corresponded to the induction measured in the enzyme levels. In conclusion, these data supported the part of the research hypothesis that cruciferous vegetables would increase Phase II enzymes levels in mouse liver, however, the data did not support the hypothesis that all the mRNA's corresponding to the enzymes would be increased by cruciferous vegetables.

Does Magnetism Affect Plant Growth? PRANEETHA KUMAR (Eagle's Landing High School, McDonough, GA)

The purpose of this project is to explore the effects of magnetism on the growth of coriander. A vast amount of literature exists on the effects of magnetic and electromagnetic fields (EMF) on human health, but little information is available on the effects of magnetism on plant growth. Research work has shown that EMF could increase the rate of calcium ion flow across plant and animal cell membranes, resulting in faster cell growth. Since the growth of plants easily can be observed, a controlled study can serve as a model for understanding the

effects of magnetism on plant growth. For this experiment ten pots with ten coriander seeds in each pot were prepared; in five pots, two identical bar magnets were placed vertically, six cm apart. The other five pots served as controls that did not contain magnets. All ten pots were observed for thirty days. The results of this experiment demonstrate that significant growth increases were obtained when plants were exposed to a magnetic field compared to the controls.

Effect of Melatonin as an Immunohancer in Vinegar Eels (*Turbatrix aceti*). TARA LEITNER (Ocean Township High School, West Park Avenue, Ocean Township, NJ 07712)

This experiment attempts to determine if melatonin will increase resistance to disease. Melatonin is a naturally found chemical secreted by the pineal gland in mammals. Its release, always in darkness, is involved in initiation of sleep. The hypothesis states that vinegar eels (*Turbatrix aceti*) given melatonin will increase their immune response to an environmentally found poison. The eels were given both poison (silver nitrate) and melatonin and the response (behavior, life span) recorded. The data suggests that the hypothesis is correct: the eels behavioral response and life span was observed in response to melatonin at varied doses, both with and independent of poison. Those groups receiving both melatonin and poison showed marked behavioral differences and increased life span over those receiving only poison.

Isolation and Purification of the Virulent Vector *Agrobacterium tumefaciens*. JENNIFER LI (North Carolina School of Science and Mathematics, Durham, NC)

Agrobacterium tumefaciens can be used as a vector for genetic engineering of dicotelynous plants. This bacterium contains a large plasmid called the Ti or tumor inducing plasmid. If the plasmid is isolated, a non-virulent gene can be ligated into the plasmid and then subsequently incorporated into a plant's genome. However, because of its large size (approximately 200 kb), current methods of plasmid isolation are tedious. As an alternative, two easier and more conventional methods of plasmic extraction were studied. One method involved the use of SDS to lyse the cells of the bacteria in an alkaline plasmid mini-preparation. Restriction analysis has supported that *A. tumefaciens* DNA has been isolated in small amounts using this method, but actual identification of the particular plasmid is inconclusive. The second procedure involved boiling *A. tumefaciens*, rupturing the cell to extract chromosomal DNA. This method, however, has had no positive results. The pAmp plasmid of *E. coli* was used as a control throughout all of the methods because of its size and relative ease of extraction from the cell.

A Reliable Whole-Mount Histochemistry Procedure for the Analysis of the Vitellaria in the Rotifer *Philodina roseola*, With Emphasis on Engrailed and Wnt Gene Expression. CORY R. LINDSAY (Laurel-Concord Public Schools) ED M. BROGIE (Laurel-Concord Public Schools)

Philodina roseola is a parthenogenetically reproducing rotifer which poses an interesting question: Being that this genus has no males within its population, and females reproduce by apomictic parthenogenesis, how do these invertebrates from a molecular standpoint, develop differently from sexually reproducing organisms? A reliable whole-mount histochemistry procedure was developed for the elucidation of the vitellaria in the rotifer *P. roseola*. Previous procedures have tried with limited success; incorporating reagents and methods that were degrading (Jeppesen, Rosa-Molinar 1995) and did not maintain the organisms three-dimensional configuration. In this way, one will actually lose information pertaining to the organisms histological composition. It is with this in mind that the construction of a protocol shall be developed which

will highlight the segment polarity genes engrailed and wnt. These genes are expressed in an antero-lateral to postero-lateral direction in nervous tissue, and are especially emphasized in segmented invertebrates such as *Drosophila melanogaster* (Patel, 1994). Coupled with the fact that *P. roseola* reproduces by means of apomictic parthenogenesis, molecular and cellular differentiation should in theory be different from those organisms which reproduce sexually.

Sound Frequencies as Attractive/Repulsive Agents For Lonestar Ticks (*Amblyomma americanum*). LISA MANFREDI (Ocean Township High School, Oakhurst, NJ)

The study was performed to determine the effects of sound frequencies on ticks as a method of decreasing the number of diseases spread yearly by ticks without involving a harmful chemical agent such as DEET. The test group of ticks was subject to six different preset sound frequencies and observed. Preliminary results showed that sound projected at frequencies similar to those created by potential hosts is detected by the tick's mechanical sensors. The result is the attraction of the ticks, making it feasible to isolate them. Ultrasonic frequencies yielded little response after a brief period of agitation.

Interaction Between Phytochrome and Cryptochrome During Seed Germination. LACHELLE M. MASON (Westmoore High School, Oklahoma City, OK)

Phytochrome is an interconvertible photoreceptor that is quintessential to morphogenesis in plants. Its application in aiding agriculturists in the concept of nighttime tillage has recently been considered and is undergoing experimentation. Greater knowledge of how this pigment regulates physiological responses might be obtained through the relationship with another photoreceptor, cryptochrome, recently isolated for the first time. In this experiment, a function of cryptochrome was found to have a striking connection with that of phytochrome. Seeds of nine different genera along with a weed seed mixture were exposed to blue (B) and red (R) light, as well as various combinations of the two, during a one week period, in the absence of other lights. Germination counts show that the group exposed to (B) had the highest percentage of germination, indicating that the activation of cryptochrome may play a role in the sprouting of seeds. The activation of cryptochrome seemed to have more affect on larger weed seeds, contrasting with the activation of phytochrome which seemed to have considerable affects solely on the smaller seeds, although size may not necessarily be a factor. The group exposed to (R) showed the next highest percentage of germination, while the percentage for the group exposed to (R) immediately followed by (B) was almost the same as the dark control. As supporting evidence of the results, the seeds exposed to three days of (R) and then (B) on the fourth, showed an increase in germination until the fourth day, as germination was then hindered, unlike the continuation in other groups on that day. This suggests that the two pigments may interact or compete in the nucleus to turn on the specific factors responsible for seed germination. But knowing that this effect of (R) and (B) is the same as the effect of (R) and far-red (FR) light, one may consider the possibility of a photo reversibility process between these two pigments.

Damaging Effects of Anthropogenic Disturbance on the Rockweed *Pelvetia compressa*. MARIN MCDONALD (Villa Park High School, Villa Park, Ca), STEVEN MURRAY and TERI GIBSON (California State University, Fullerton, Ca)

Pelvetia compressa (O. Fucales), a foliose brown algae,

forms canopies which support a high diversity of invertebrates and seaweed on semi-protected rocky shores throughout southern California. Because of its morphology and distribution on the upper shore, we hypothesized that *P. compressa* would be damaged by human foot traffic. We tested this hypothesis at four sites, two of which were known to receive high human use and two where the intensity of human foot traffic was low. We randomly located 15 plots (0.5m x 0.7m) in the *P. compressa* assemblage at each site. Plots were grouped into 5 blocks of 3 and randomly assigned to 0 (control), 150-, or 300-step trampling treatments within each block. Trampling treatments were applied once per month at each site for 16 months. Trampling significantly reduced the *P. compressa* f. *compressa* cover at three of the mainland sites but had little effect on the gracilis form of *P. compressa* found at our low use site on San Clemente Island. Trampling treatments resulted in significantly more detached biomass at our low use mainland site than at our two high use mainland sites, although declines were less than expected based on previous studies performed at more northerly latitudes. Reproductive material, which is confined to branch tips in this seaweed, accounted for a progressively greater proportion of the *P. compressa* biomass detached following trampling treatments. Our results reveal that the extent of damage from trampling treatments varies between forms of *P. compressa* and also between sites. Moreover, a potentially important impact of visitor foot traffic is the loss of reproductive material due to branch breakage. [Supported by the SCAS RTP Program, USC Sea Grant, and the California State Resources Agency]

The Effect of Electromagnetic Emissions on Television Viewers.

SHAUNA MCTEAGUE (Lin-Wood Public High School, Lincoln, NH) and Dr. PETER FALETRA

When a person is viewing a television, what they are seeing is a transmission of images by means of electromagnetic radiation. Ignoring the audio component, most people would assume that the experience is purely visual. This experiment tests the hypothesis that television viewers are "attracted" not only to the television screen by the visual and auditory components, but also by electromagnetic emissions. The experiment was set up in a small room with two televisions located on different sides of the room. In the first experiment, the screen was darkened by turning the brightness down on the television that was on. In the control experiment both televisions were on with the screens darkened. In the negative control experiment neither of the televisions were on. Subjects were alone when viewing. They were centrally placed in the room to assure equal opportunity viewing of each of the televisions. A video record was made of any physical reactions by the subjects to the televisions.

Determination of the Site of Action for the Stimulatory Effect of Oxytocin on the Preovulatory Secretion of LHRH in Cycling Female Rats. AMANDA MOREY and JODI SULLIVAN (Sentinel High School, Missoula, MT), CRAIG JOHNSTON (School of Pharmacy, University of Montana, Missoula, MT)

Albino female rats were monitored in order to determine the location of the stimulatory effects of oxytocin on LHRH release. The phase of each rat in the estrous cycle was determined by monitoring daily vaginal cytology. Medial-basal hypothalamus or median eminence tissues were subsequently obtained from these animals at appropriate times. A series of tests were then performed in order to determine the amount of LHRH secretion from each tissue in the basal condition, in response to oxytocin, or in response to high potassium solutions. Results showed a highly significant difference between Diestrus and Proestrus when oxytocin was introduced to the medial-basal hypothalamic tissues ($P < .01$). There was no stimulatory effect detected from the median eminence tissues. It was shown that oxytocin is stimulatory to LHRH release on the afternoon of Proestrus at the level of the medial-basal hypothalamus, but not on Diestrus.

Thus, the oxytocin target cells which are responsible for mediating the stimulatory influence of oxytocin must be exerted at a level higher than the terminals which are located in the median eminence. [NIH Grant: RR11796]

Multi-Residue Procedure for the Determination of Captan, Malathion, and Methoxychlor in Malus. AZEEM SHERALI and ARASH MOSTAGHIMI (Blacksburg, High School, Blacksburg, VA)

The purpose of this project was to develop a multi-residue procedure for the extraction and measurement of the pesticides captan, malathion, and methoxychlor from an apple matrix. The hypothesis was that current procedures for the extraction of captan, malathion, and methoxychlor from various matrices could be combined into a single procedure for the extraction of the enumerated pesticides from apples. Such a procedure is advantageous because it allows for the detection of the enumerated pesticides with a single procedure, thus saving, time, money and resources, while reducing the risk of work-related health problems. After the procedure was initially developed and tested, the efficacy of the procedure at recovering smaller amounts of pesticide was tested. To do this, the amount of fortified pesticide was decreased gradually, from the original 5ug/10g, sample to a 0.5ug/10g sample. The procedure was found to yield results which were adequate, reproducible, and robust. Furthermore, the procedure was able to effectively recover trace amounts of pesticide even lower than the levels of pesticide permitted by the EPA to exist in apples sold in the United States. Thus, a multi-residue procedure for the determination of captan, malathion, and methoxychlor was developed which is effective in finding trace amounts of pesticide in apples, and which can be used by the apple and food-processing industries. The contribution of this project is the creation of a simple and more efficient procedure for the extraction of the enumerated pesticides which saves time, money and resources without influencing the validity of test results.

Neuregulin Promotes Growth of Neuron Precursor Cells From Human Brain. CHRISTOPHER J. PIETRAS, DAVID HINDEN (Harvard-Westlake School, North Hollywood, CA), NANCY WONGVIPAT and Dr. MARK PEGRAM (Department of Medicine, University of California School of Medicine, Los Angeles, CA)

Neuron precursor cells from human cerebral cortex (HCN) can regenerate neurons, but the growth-regulatory pathway is poorly understood. HCN cells were cultivated in vitro and assessed for expression of neuregulin growth factor and its reported receptors, erb B2, erb B3 and erb B4. One major form of neuregulin (45 kd) is expressed in HCN cells, and erb B4 receptors (180 kd) are detected by utilization of protein electrophoresis and immunoblotting methods. When added to cultures of HCN cells, 10 nM neuregulin increases tyrosine phosphorylation of erb B4 receptor and that of p42/p44 mitogen-activated protein (MAP) kinase by 15 minutes. In contrast, at 15 minutes, neuregulin elicits marked reduction in tyrosine phosphorylation of p38 MAP kinase. This differential modulation of two growth factor signal transduction pathways by neuregulin is associated with neurite extension, DNA synthesis and neuron growth. Within 24 hours, neuregulin elicits significant rounding of neurons and extension of processes as assessed by scanning electron microscopy. At 72 hours, the number of extensions in neuregulin-treated HCN cells exceeds those of control neurons by 3-fold ($P < 0.05$). In addition, neuregulin stimulates

increased DNA synthesis to 5-times control levels and neuron cell division to 1.2-times control ($P < 0.01$). These responses to neuregulin are blocked by prior treatment of HCN cells with a polyclonal antibody to neuregulin (1:500 dilution), suggesting specificity of the effect. Thus, neuregulin has direct effects on brain neuron precursor cells and may ultimately prove useful in the therapy of neurodegenerative diseases and brain injuries. [Funded by: University of California Research Grants]

Comparative Anticoagulant Profile of Synthetic and Recombinant Thrombin and Factor Xa Inhibitors and their Interactions. CANDI REINCKE (Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506-1000) Dr. JAWED FAREED and Dr. OMAR IQBAL (Department of Pathology, Loyola University Medical Center, 2160 South First Avenue, Maywood, IL 60153)

Besides heparin, a conventionally used anticoagulant drug, there are newer drugs of synthetic and recombinant origin such as thrombin and factor Xa inhibitors. These drugs are specific in their inhibition of thrombin or factor Xa in the coagulation cascade. In order to determine their anticoagulant profile, these agents were supplemented in normal human plasma and whole blood at various levels. Different assays to determine their anticoagulant effect were performed. Of the various agents tested, Argatroban was found to be the most potent of the thrombin inhibitors, when compared to rHirudin, PEG Hirudin, and the factor Xa inhibitor Dx9O65a. When each of the thrombin inhibitors was combined with Dx9O65a, an additive or synergistic effect occurred in the anticoagulant response. However, these results are assay dependent. While the increase in the anticoagulant response was concentration dependent, it was strongly dependent on the type of assay used and the nature of the agent. For the optimal development of new anticoagulant drugs, valid pre-clinical studies are needed to demonstrate their interactions with other anti-thrombotic agents.

Platte Quality—Does it Matter? CORTNY M. RIBLETT (Central City High School, Central City, NE) Mrs. JUDY WILL-IAMS (Central City High School, Central City, NE)

The Platte River is one of the most important rivers in Nebraska's history. Today, we use the river for farming and recreation. The purpose of my research was to determine if the water quality from different sites of the Platte River would affect the growth of the Wisconsin Fast Plant. My collection sites included one half mile upstream from the Central City Water Disposal Plant pipe outlet on the Platte, the pipe location itself, and one half mile downstream from the pipe outlet. After collecting the water, all testing for quality of the water was done. Using the knowledge gained from the testing of the water quality, I hypothesized that water quality of three sites from the Platte River would affect growth of the Wisconsin Fast Plant due to the quality of collected water. Distilled water was used in the control set-up, and the three experimental set-ups were watered with the water collected from the three Platte River sites. I observed the plants for 35 days, and observed the immediate effect on germination, short term effects on plant heights, and the general appearance of the plants. The control was superior in growth and development to that of the experimental set-ups. In order from highest to lowest quality of growth and development in the experimental set-ups, the results were upstream location, downstream location, and then the pipe outlet location. I concluded that the Platte River water had an overall negative affect on the growth of the Wisconsin Fast Plant.

The Effects of Geographical Location on the Growth Rate of *Ulmus americana*. LINDSAY A. ROGERS (Burke High School, Omaha, NE)

The growth rates of upland *Ulmus americana* trees versus flood plain *Ulmus americana* trees were measured to determine if the geographical location made a difference in the growth. Ten upland and ten flood plain tree cores were taken from Neale Woods during the months of December 1996 through February 1997. The cores were glued to a mounting block and sanded to enhance the visibility of the rings. A microscope and a vernier caliper were then used to measure the length of each individual ring for the past twenty years. Precipitation information was received from NOAA in Valley, Nebraska. The results showed a significant difference ($p < 0.001$) between the growth of upland trees and the growth of flood plain trees. The upland trees grew significantly more than the flood plain trees. Mean growths were 3.92 mm and 2.77 mm respectively. The flood plain trees had less variation in yearly growth for eighteen of the twenty years tested. Neither the upland nor the flood plain trees had a strong correlation to precipitation ($p < 0.12$ and $p < 0.27$ respectively). There was a correlation between the mean upland growth and the mean flood plain growth ($p < 0.73$).

The Effects of Different Growth Conditions on Neuronal Survival and Neurite Outgrowth. RACHAEL A. SCHAFFNER (Bishop O'Connell High School, Arlington, VA)

The purpose of this experiment was to determine if astrocytes had an effect on neuronal survival and neurite outgrowth. Cortical neurons from 17 day-old rat embryos were grown in serum-free medium in 35 mm dishes in three conditions 1) on poly-D-lysine, 2) on a layer of cortical astrocytes, or 3) on poly-D-lysine in serum-free medium preconditioned by astrocytes. After 24 hours, cultures were fixed and stained with fluorescent labeled antibodies specific for neurons or astrocytes. Cultures were examined in a microscope and fluorescent pictures were captured by a computer program that measured neurite length. The results indicated that neuronal survival (number of cells per field) was the same in all three growth conditions. Neurites were longest in neurons grown on astrocytes and shortest in neurons grown on poly-D-lysine. The number of neurons with processes (neurites) was similar when cells were grown on astrocytes or in astrocyte conditioned medium. This was significantly greater than the number of neurons with processes grown on poly-D-lysine alone. Therefore, astrocytes have an effect on neuronal growth, namely neurite sprouting and length, and this effect can also be gotten from medium exposed to astrocytes suggesting that astrocytes secrete growth factor(s) into the medium.

Degradation of Photosynthetic Algae Exposed to Crude Oil in Different Water Temperatures. AMANDA RAE SCHILLER (Central Lee High School, Donnellson, IA)

The reason that I chose to research this project was to figure out how photosynthetic organisms are affected by crude oil during an oil spill. My project concerns the tolerance of these photosynthetic algae subjected to oil spills. My research shows that the population of the algae studied decreases from the presence of crude oil. My research looks at the affect of crude oil on individual species of planktonic algae when oil spills occur in water samples at differing temperatures. I tested the algal organism growth in an artificial oil spill in which samples of algae were challenged to crude oil in water temperature during the Valdez Oil Spill in Alaska. The growth of algae at this temperature was compared to algae grown under identical growth conditions, except using warmer water

temperature. Two types of aquatic situations were used as models. One set was grown in freshwater, the other was grown in a marine environment. The results have shown that there is no appreciable difference in the degradation of growth grown at cooler temperatures as compared to the growth at warmer temperatures. Present ongoing research demonstrates continued investigations using additional tests of marine algae grown at test conditions where algae was subjected directly to crude oil as opposed to the aromatic crude oil fumes directly over the suspension of algae. These results will show the affect of aerosol fumes of crude oil as compared to the direct water contamination during the spills.

The Bottom Line. MARK SCUFFHAM (Algona High School, Algona, IA)

This purpose of this project was to find the most cost effective of seven different feed rations for nursery age pigs. This project was done to find a way to cut the cost of pork production on our farm. The cost of feed per ton at this stage of feeding is the most expensive. The ration that we were using was the control for the test. Pigs were weaned and divided into pens in a climate-controlled nursery with free access to feed and water. Feed was measured and pigs were weighed at the beginning and end of the test. Consideration was given to cost of housing and days to gain the maximum weight. Calculations were done to determine the most cost-effective ration. As a result of this project the feeding program for nursery age pigs on our farm has changed. Because of the high rate of gain for the pigs on ration 1, the new feeding program starts pigs on this ration, a complete pelleted feed, for seven days and then switches to ration 7, the most cost effective. Ration 7 is: Form A-Wean IO + Spectra-Form 250 + 400 SBM + 1250 corn. The fast start with ration 1 is important because pigs that get off to a fast start continue to gain faster than others. Form-A-Feed Incorporated provided all the rations for this project.

Development of Gene Therapy Techniques to Investigate the Feasibility of In Vivo Immunological Modulation for the Treatment of Cancer: A Two-year Study. SAPAN S. SHAH (W.D. Mills University Studies High School, Little Rock, AR) Dr. NIKHIL C. MUNSHI (Arkansas Cancer Research Center, Little Rock, AR)

For patients suffering from a wide range of cancers, numerous immunological treatments are being proposed which ideally would result in the induction of an anti-cancer response through each patient's own immune system. However, clinical application of such propositions has been difficult due to an incomplete understanding of the intracellular processes of donated immune cells and ultimate side effects caused by these cells after infusion into patients. This experimentation focused on these two interrelated parts: determining the translocation (homing) properties of transplanted immune cells and the feasibility of using a suicide gene transduced into immune cells as a regulating agent to counter complications of these infusions. The suicide gene, herpes simplex virus type 1-thymidine kinase (HSV1-TK), was applied to a murine myeloma model to examine feasibility of *in vivo* cell death. The cell targeting experimentation observed anatomical location after transplantation of bone marrow stromal cells transduced with a marker gene. The HSV1-TK transduced cells showed significant cell death, providing strong evidence supporting the feasibility of suicide gene transduction as a regulating measure. The stromal cells showed preferential transplantation into the spleen and the bone marrow, indicating that perhaps there are patterns of cell transplantation.

Identifying Genes Responsible for the Suppression of the Requirement for Translation Elongation Factor 1Beta.

JOANNA SLUSKY (Hillel High School, Ocean, NJ) ANNE CARR-SCHMID and Dr. TERRI GOSS KINZY (UMDNJ Robert Wood Johnson Medical School, Piscataway, NJ)

Translation Elongation Factor-1 (EF-1) plays an integral role in translation by bringing the tRNA with an attached amino acid to the ribosomal translation site. The sub-unit binds to the aminoacyl-tRNA in a GTP-dependent manner. This complex binds to the ribosome and GTP is hydrolyzed, thereby depositing the aminoacyl-tRNA at the ribosome. The sub-unit restores the EF-1 -GDP to an EF-1 -GTP for the next elongation cycle. Disrupting renders the cell nonviable. However, if an extra gene encoding of EF-1 is present in an EF-1 deficient strain, the cell is viable but slow growing and has conditional growth defects and drug sensitivities. We isolated fifteen mutations that suppressed the phenotypes of a cell deficient in EF-1, called SBD for suppressor of an EF-1 β deficiency. Twelve of these mutations were found to be encoded on the chromosomal DNA. Of these twelve, seven had cold sensitive, growth, or drug sensitive phenotypes when the normal genotype was reproduced by restoring and removing the extra copy of . Of the seven, further genetic analysis of six indicated that four of the mutations are in the same complementation group. We cloned one mutation from that complementation group by complementation of the cold sensitive growth defect. Multiple plasmids that allowed growth in the cold were isolated and characterized. Sequence analysis has determined that at least one of the plasmids contain a gene that encodes for a ribosomal protein. We hypothesize that these gene products may interact with the EF-1 complex or help regulate its activity. Knowing the function of the SBD protein will afford an enhanced understanding of the translation elongation pathway.

The Transformation of Agrobacterium tumefaciens with the lux Phosphorescence Gene of Photobacterium fischeri. CLIFFORD SOFIELD (Ocean Township High School, Oakhurst, NJ)

The purpose of this research is to create a strain of Agrobacterium tumefaciens expressing the lux phosphorescence operon of Photobacterium fischeri. While many marine bacteria exhibit phosphorescence, the plant pathogen Agrobacterium tumefaciens does not. Therefore, the lux gene would serve as a useful marker in research with Agrobacterium or bacteria like it. The lux operon, which is contained on pBR322, will be recombined with disabled Ti-plasmid, probably using the Sal I restriction enzyme. The resultant lux containing Ti-plasmid will be introduced into a strain of Agrobacterium using chemically direct DNA transformation. Possible uses of a strain of lux-containing Agrobacterium include employment as a vector to infect dicotyledonous plants with the lux gene, as a model for infecting other bacteria with the lux gene, or simply as a genetic marker. Research is being conducted at this time.

Growth Studies of the Showy Lady's Slipper in Axenic Culture. KATIE SOKOLSKI and Dr. PETER FALETRA (Lin-Wood Public High School, Lincoln, NH)

An efficient method of axenic seed propagation of large numbers of *Cypripedium reginae* Walt was developed as a means of supplying seedlings for a restoration attempt in the northeast United States. Seedlings were grown on 1/4 strength Murashige and Skoog basal salts supplemented with 100 ml/l coconut milk and solidified with 7g/l agar. The development of *Cypripedium reginae* was studied with both light and scanning electron microscopy. Dose response experiments of seed germination versus exposure time to sodium hypochlorite indicate germina-

tion and developmental progress was greatest at longer exposure times. Experiments on seed germination subsequent to exposure to increased concentrations of sodium hypochlorite (0%, 0.125%, 0.25%, and 0.5%) indicate germination and developmental progress was greatest at higher concentrations. Earliest germination was seen at 14 days after initial plating of seed. Stage 5 seedlings were present 27 days after initial plating and in greatest proportion in seeds exposed to longer times in sodium hypochlorite. Micropropagation experiments showed a success rate of 32% with an indication of difficulty in cutting the seedlings to allow for both shoot and root development. Approximately 10,000 seedlings have been successfully germinated and have developed both healthy roots and shoots. [Funded by a Tapestry Grant (Toyota Co.)]

In Vitro Selection of Combinatorial RNA Libraries Using Autoimmune Patient Serum. CHARLES THOMPSON, III (Hillside High School, Durham, NC)

Lupus (SLE) is an autoimmune disease in which antibodies attack the immune system. Several symptoms of SLE are hair loss and kidney problems. In previous work, it has been found that autoantibodies are frequently found in autoimmune patient sera. The antibodies attach themselves to the nucleic acids RNA and DNA, and proteins. The objective of this study was to work with RNA from patients' sera with SLE and determine why the antibodies attach themselves with RNA. It was hypothesized that when the antibodies attach to RNA, it attaches to a certain area on the RNA strand. To better address this question, combinatorial selection on a random pool of RNA library was done. This involved amplification of DNA, using the Polymerase Chain Reaction techniques in order to provide a template for RNA transcription. Following transcription, antibodies were introduced into the pool of RNA to determine the site of antibody attachment to RNA. Preliminary results from prior experiments suggests that the antibodies bind to specific sites on the RNA ligand in the Stem-loop region. The reason for this reactivity is not fully understood. Additional experiments are in progress to identify the exact sequence of nitrogen bases on the RNA strand to which the antibodies attach.

Neuromodulation of Cytokine Synthesis By T-Helper Cells. ANDREW M. TORRES (Illinois Mathematics & Science Academy, 1500 West Sullivan Road, Aurora, IL 60506-1000) Dr. VIRGINIA M. SANDERS (Department of Cell Biology, Neurobiology & Anatomy, Loyola University Medical Center, Maywood, IL)

The long-term goal of our research is to understand the mechanisms by which the binding of the neurotransmitter norepinephrine to the beta-2-adrenergic receptor (b2AR) modulates the ability of T-helper 1 (Th1) and Th2 cells to produce the cytokines Interferon (IFN)-g and Interleukin (IL)-4, respectively. Previous studies have shown that Th1 cells express a detectable level of the b2AR, but that Th2 cells do not. Thus, my hypothesis is that exposure to a b2AR agonist will differentially affect IFN-g production by Th1 cells, depending on the time of agonist exposure in relation to cell activation, but will not affect IL-4 production by Th2 cells. The experimental approach employed uses the Golgi transport inhibitor Brefeldin A, fluorescently-labeled antibodies and FACS analysis to quantify both the number of cells producing cytokine and the level of cytokine produced by either clones or newly-generated Th1 and Th2 cells exposed to the b2AR agonist terbutaline before and after their activation. Preliminary results support my hypothesis. Future studies will employ adrenergic receptor subtype-specific antagonists to determine if norepinephrine binding specifically to the b2AR mediates a similar effect on Th cell cytokine production. These data suggest that stimuli which bind to the b2AR, such as the neurotransmitter norepinephrine, may play a role in modulating Th

cell function and may play a role in the development or progression of immune-related diseases and illnesses such as rheumatoid arthritis and the common flu.

ATP-Induced Morphological Changes in H. Pseudoligactis. DERRICK K. TUNG (Illinois Mathematics & Science Academy, 1500 West Sullivan Road, Aurora, IL 60506-1000) and VICKI MUSIAL (Biology Department, Illinois Mathematics & Science Academy, 1500 West Sullivan Road, Aurora, IL 60506-1000)

H. pseudoligactis (Brown Hydra) were placed in various concentrations of ATP (adenosine tri-phosphate) at .125M, .25M, and .5M. The hypothesis was that ATP would cause overall body elongation of the hydra within a three-day period. [Stuart A. Newman. Nature New Biology, Vol. 244, No. 134, pp. 126128, July 25, 1973] The addition of ATP to the environment caused visible elongation in total body length. However a great deal of the elongation occurred specifically within the gastric region and the budding region. Some elongation also seemed to occur at in the peduncle however it was very minimal. Compared to humans, hydra are very simple creatures. Since ATP is produced naturally in most complex organisms, the exploration of using ATP as a treatment in the environment of hydra, either externally or internally, could lead to possible uses of how ATP treatments could enhance and benefit the lives of more complex organisms such as humans in the fields of growth and development.

UV-Damage Associated Skin Cancer: Oncogene Activation and Associated Alterations in Cell Cycle Protein Expression in Basal Cell Carcinomas. STEVEN E. TUTTLE (St. Ann's Hospital, Westerville, Ohio, 43081)

Oncogene activation and associated alteration in cell cycle protein expression were studied in basal cell carcinomas. Previous experiments had shown quantifiable DNA damage induced by Ultraviolet (UV) Radiation. UV induced mutation in DNA can lead to oncogene activation. The purpose of this experiment was to determine whether UV associated malignancies, such as basal cell carcinomas, are associated with oncogene activation and subsequent changes in the malignant cells' cycle. It is known that normal expression of bcl-2 and p53 are essential to controlling steps in normal programmed cell death (apoptosis). Activation of oncogenes bcl-2 and p53 were studied, and correlated with cell cycle markers for proliferation (Ki-67) and apoptosis (SPO-1). Ten cases of basal cell carcinoma were studied using immunohistochemical techniques. p53 oncogene activation was found in 100% of the malignancies, while bcl-2 activation was present in 90%. Proliferating cell counts averaged 2-3 times higher in cancerous cells than in adjacent epithelium. The apoptosis (programmed cell death) rate of the cancerous cells was found to be 20-30 times less than that of the normal tissue. This study suggests that oncogenes p53 and bcl-2 play a significant role in the malignant transformation in basal cell carcinomas. It also suggests that although basal cell carcinomas may proliferate at a slightly increased rate they most likely continue to expand mainly because aging cells do not undergo normal cell death (apoptosis).

A Study of the Effects of Environmental Estrogens on Gambusia. ANNE WILLIAMS AND EMILY MEEKER (Enloe High School, Raleigh, NC)

Tofu is a soy product which contains phytoestrogens. Phytoestrogens are plant estrogens that have been shown to

mimic the vertebrate hormone, estrogen, and bind to vertebrate hormone receptors. In the experimental group of this study, guppies were exposed to the phytoestrogen (tofu), which acts as an environmental estrogen. Guppies are small freshwater fish who, like humans, give live births. In their natural environment of ponds, swamps, and streams, guppies feed on small insects. The hypothesis is that the environmental estrogens will inhibit the reproductive cycle of females by binding to the hormone receptors and simulating pregnancy. The number of offspring from the control and experimental tanks were compared to determine if the environmental estrogens affect the reproductive cycle. Secondary sex organs of male and females were also investigated to see if environmental estrogens also affect them. The results showed a treatment effect due to phytoestrogens.

Temporal and Spatial Mapping of Integrin and Vinculin Expression During Hamster Submandibular Gland Biogenesis. SALIM H. AHMED (Thomas Jefferson High School for Science & Technology, Alexandria, VA), Dr. MARIA KUKURUZINSKA (Center for Advanced Biomedical Research, Boston University Medical Center, Boston, MA)

Hamster submandibular salivary glands (SMGS) develop postnatally through a process that involves, in part, adhesive molecules such as α_1 and α_5 integrins and vinculin. To better understand how these molecules are involved in SMG development, the relative levels of α_1 integrin present in hamster SMGs at various stages of postnatal development were determined *in vitro* using immunodetection blotting techniques. The locations of the α_1 and α_5 integrins and vinculin were also examined *in situ* using confocal microscopy. It was found that the levels of integrin increased as the SMGs developed. Both α_1 and α_5 integrins were diffuse during the early stages of SMG development but localized to the basal lamina in the later stages of SMG development. The vinculin was also diffuse at first but then localized to the cell interfaces by day 5 and finally localized to the basal lamina by day 33. The presence of these α_1 and α_5 integrins and vinculin and their dramatically changing localization trends during critical stages of SMG development suggest that they play a role in binding salivary cells to the basal lamina.

Characterization of Diacylglycerol (DG) Kinase Expressed in Human Neutrophils. COREY ZEHNGEBOT (Lake Highland Preparatory School, Orlando, FL), Dr. CATHERINE M.E. CHAMPAGNE (Center for Advanced Biomedical Research, Goldman School of Graduate Dentistry, Boston University, Boston, MA)

Localized juvenile periodontitis (LJP) is a localized infection of the tissues supporting the teeth, discernible by its association with *Actinobacillus actinomycetemcomitans* as well as a unique immune response, suggesting a potential genetic basis for the disease. There is mounting evidence that abnormal function of diacylglycerol kinase (DG kinase) enzyme in LJP polymorphonuclear neutrophils (PMNs) is related to expression of the disease: there are apparent decreased levels of DG kinase mRNA in LJP PMNs; similarly, there exists different DG kinase mRNA molecules in normal PMNs. Distribution of DG kinase isozymes in oral tissues has yet to be examined. In the present study, we examine whether the various DG kinase mRNA expressed in LJP PMNs are different in comparison to control PMNs, either in terms of expressivity levels or in terms of the specific mRNA molecules expressed. Following preparation of peripheral blood PMNs and extraction of total RNA, cDNA was synthesized using M-MLV reverse transcriptase. Various oligonucleotide primers were designed to amplify specific DG kinase mRNA species by polymerase chain reaction (PCR). PCR

products were subsequently analyzed by agarose gel electrophoresis. First, control PCR experiments were conducted with prepared clones from the different isoforms of DG kinase expressed in human control PMNs. Although these control PCR experiments worked fairly well, results from RT-PCR experiments with control PMN RNA were inconclusive, hindering PCR of LJP PMNs. Problems resulting from design of oligonucleotide primers and PCR methodology are discussed, and complementary experiments are outlined. [Funded by NIH-NIDR Grant: DEO-6436]

Sphingoid Bases in Central Nervous System Development. BRIANNE JENNA GOROD (Academic Magnet High School, Charleston, SC) and SOMSANKAR DASGUPTA (Department of Neurology, Medical University of South Carolina, Charleston, SC)

Glycosphingolipids (GSLs) are important cell membrane constituents that participate in a wide variety of biological phenomena, including cellular differentiation and growth. As the structural backbones for the GSLs ceramide and sphingoids serve as key determinants in sphingolipid metabolism. Since sphingoids and ceramides regulate the synthesis of GSLs that function in cellular differentiation and development, this project was approached with the hypothesis that the sphingoids and ceramide play a unique role in CNS development and myelinogenesis. In order to test this hypothesis, sphingoids and ceramide were purified and assayed in rat brain development from the embryonic to adult stages of development. Sphingosine and psychosine were identified in normal vertebrate CNS, and the developmental profile of sphingoid content indicated a degree of variation at the critical stages of brain development, with a peak occurring at postnatal (P) day 21. Ceramide concentration also increased with age, and a peak occurred between P15 and P21, suggesting the importance of ceramide in myelinogenesis. It is noteworthy that sphingosine and psychosine had not been identified as normal brain constituents until this study. Moreover, in light of recent reports that ceramide and sphingoids are mediators of cell apoptosis, this finding that they may actually participate in CNS development and myelinogenesis is intriguing. Further careful examination of their biochemical pathways should elucidate their roles as interactive biomolecules.

A Water Quality Study of the Perennial Feeder Streams into Patoka Lake. MORGAN D. DUSCH (Paoli Junior-Senior High School, Paoli, IN)

Patoka Lake, the source of this project, is a great asset to Orange County because it is so dependent upon Patoka Lake as a major water supply. If this lake is contaminated, the county would ultimately suffer the consequences. This research project was designed to determine the water quality of major perennial entry streams into Patoka Lake. The possible presence of pathogenic contamination as indicated by coliform testing was identified. Major inorganic contaminants were also identified by testing for nitrates, phosphates, and chlorides. The first element of testing, which was directed, was the testing for coliform bacteria. This test was conducted by using Coliscan Easygel. The next tests were run on the possible nitrate, phosphate, and chloride contamination using LaMotte test kits for each. There are six major perennial feeder streams at which samples were taken. Three samples were taken a total number of three times. Based on the data collected, the following conclusions were made: 1) there was no significant change in the phosphate levels from each site or trial, and all levels were found at an acceptable rate; 2) chlorides and nitrates also remained stationary and were found at an acceptable standard; 3) total bacteria counts were higher than the

normal standard; and, 4) Fecal coliform counts were not a significant source of contamination in any of the six test sites. As the original hypotheses stated, chlorides were close to a normal rate, and possibly due to cooler weather and seasonal conditions, fecal coliform counts were low; however, the hypothesis was proven wrong in that nitrate tests were found normal and phosphates were at an acceptable standard.

Physical Sciences

February 13, 1998 3:00-5:00pm

Biomimetics: Materials Engineering in Nature, Phase III. KANIKA CHAWLA (Socorro High School, Socorro, NM) JOHN OSOWSKI (Energetic Materials Research and Testing Center, Socorro, NM)

Biomimetics is the mimicking of structures in nature, such as seashells, to produce tailor-made materials. In phase one, I studied the microstructure, hardness, and strength of four seashells. I showed that principles of materials engineering can be found in nature. In phase two, the alternating hard and soft layer structure of a spider conch seashell was used as a model for making an artificial composite. The artificial composite showed damage tolerant properties, i.e., interfacial de-lamination and crack deflection similar to that observed in the spider conch. In phase three, the Finite Element Method (FEM) was used to model the artificial composite and to compare the results of the model to that of the actual composite. The hypothesis was that the FEM modeling of the engineered composite would allow one to predict results observed experimentally. The COSMOS' FEM code was used to simulate fracture behavior of the composite in a three-point bend test. The results portrayed the initiation of cracking in the outermost layer, followed by crack deflection at the interface. The hypothesis was verified and one could use computer simulation by FEM to gain insight into the fracture behavior of a composite that mimicked the spider conch seashell.

Electrochromic Displays. DEBORAH CHEN (Jasper High School, Plano, TX) Dr. FERRARIS (University of Texas at Dallas, Dallas, TX) Dr. GARY EVANS and JAY KIRK (School of Engineering and Applied Science, Southern Methodist University, Dallas, TX)

Electrochromism is a change in light absorption as a consequence of a reversible electrochemical reaction. It is a color production by means of electrochemistry. The electrochemical reaction is always controlled by the electron reaction. Each display picture can be thought of as a miniature battery. The picture can be small or large depending on the applications. The electrochromic displays were prepared by conductive polymer materials and electrolytes sandwiched between two pieces of transparent patterned or unpatterned indium tin oxide (ITO) glass or plastic substrate. The plastic substrate (mylar) is very applicable because it can be used for the flexible displays to meet the specific shape, size, and weight requirements. The materials were cast or spin coated onto the ITO electrodes. The patterned electrodes were prepared by the photo-lithographic process. The photo-masks used for patterning the electrodes were made from the transparency materials that have images from the computer generated patterns. A successful display device by use of ITO glass or mylar substrate as the electrodes and poly (ethylene dioxy thiophene) as the electrochromic material, had been fabricated and showed great response time, switchability, and color intensity. Electrochromic displays have great potential for applications 'in signs, mirrors, and smart windows.

Search for Violation of Charge Conjugation Invariance in Electromagnetic Pi-Zero Decay. JULIE COMERFORD (Illinois Mathematics and Science Academy, 1500 West Sullivan Road., Aurora, IL 60506-1000) Dr. YAU WAH (Department of High Energy Physics, University of Chicago, 5640 South Ellis Avenue, Chicago, IL 60632)

Historically, much progress has been made in elementary particle physics after symmetry breaking discoveries, such as parity violation and CP violation in weak interaction. Theoretically, charge conjugation invariance is conserved in electromagnetic interaction and presently there is no experimental evidence of violation. The KTeV (Kaons at TeVatron) experiment at Fermi National Accelerator Laboratory finished collecting data with a state-of-the-art detector in September of 1997. This data allows the search for the decay mode pi-zero to three gamma rays, which violates charge conjugation symmetry if observed. The pi-zero comes from the copious K-long to three pi-zero decay. The search looks for the signature of the first pi-zero decaying to two gamma rays, the second pi-zero decaying to an electron, a positron, and a gamma ray, and the third pi-zero decaying to three gamma rays. Analysis algorithms based on relativistic kinematics and geometric constraints are being developed to reconstruct these events.

The Effect of Levitation Height of a Propelled Car on the Time Taken to Complete a Magnetic Levitation Track.

JAKOB B. HARMON (Atlee High School, Mechanicsville, VA)

The paradigm of transportation will change dramatically in coming years due to congestion, fewer energy resources, pollution, and increased demand on time. The experimenter wished to investigate magnetic levitation to understand the advantage of maglev trains. The purpose of this experiment, then, was to study the effect of the levitation height of a propelled maglev car on the time taken for it to complete a straight course of track. It was hypothesized that if the height of levitation was increased, the stability of the vehicle would decrease, and the time to complete the track would increase. The levitated height of the car above the track was changed by the addition of magnets to the bottom side of the car. The mass of the car, the course length, and the light timing system remained constant. At a levitation height of 2.8mm, which served as the control, the mean time for the car to complete the track was 2.8 seconds. At heights of 4.0, 5.3, 6.5, 7.8, and 9.0mm, the mean times were 2.1, 1.9, 1.7, 1.7, and 1.6 seconds respectively. The data showed that if the levitation height of the car was increased, then the time to complete the track was decreased. In rejecting the hypothesis, the experimenter concluded that levitation at increased heights on a straight course does not lessen stability, and that the vehicle will travel more efficiently. For future study, experiments could test the optimum height of a maglev vehicle in order to complete a curved or gradient course.

Evaluation Functions and Recursive Searchtree Algorithms for Connect Four™; An Investigation of Artificial Intelligence, Darwinian Testing Techniques, and MINIMAX Game Theory. MATTHEW HUENERFAUTH (Devon Preparatory School, Devon, PA)

The purpose of this experiment was to determine the most effective strategy for Connect Four™ which could be incorporated into a computer opponent. From information provided by Parker Brothers, it was hypothesized that if a strategy searched for patterns on the board then those strategies balanced between aggression and defense-in which the pieces are able to be found in several different orientations on the board and which contained

more of one player's markers would be the most effective. A human vs. human version of the game was created to test some early portions of the code. Next, a pattern-searching evaluation function was created to determine which of the possible future boards imagined by the program would be the most favorable for the computer player. Then, a human vs. computer game was created with a one-move-ahead pattern search. After the searchtree was increased to four levels ahead, a Darwinian natural selection program was created to allow randomly generated versions of the code to compete. The winner of each match survived to play a mutation of itself; in this way, a successful strategy emerged as a "champion." The best strategy was plugged into the original four-level searchtree version of the program. Human subjects competed against this program and the win/loss tally of these games was recorded. The winning strategy's logic values supported the hypothesis. Many problems which are usually "solved" in a subjective, best-guess manner can actually be solved scientifically using a natural selection program; questions involving the values or locations of a finite set of variables are well-suited to this technique.

Extending Pick's Theorem to Unorthodox Systems.

KENDRICK N. KAY (Lakeside High School, Evans, GA)

Pick's Theorem expresses the area of any polygon in the coordinate plane whose vertices are lattice points (points with integral coordinates) as a function of two variables: the number of lattice points on and the number within the polygon. In research performed previously, the theorem was extended with substantial success to higher dimensions. This year, however, in order to obtain even more extensive results, a simpler alternative was chosen: can the assumptions made by Pick's Theorem be eliminated? The major assumptions chosen and examined are that the vertices lie on lattice points, that the points in consideration are arranged in a unit lattice, and that the figure in consideration is a closed polygon. The applicability of the results to higher dimensional systems was also investigated. Several critical developments were reached, including an interesting algorithm applicable to a genre of triangles more inclusive than the one to which Pick's Theorem can be applied. Nevertheless, the multitude of flashes of insight and ideas is not to be forgotten and actually contributes greatly to the larger picture—a comprehension of the tenuous relationship between the theorem and the system which it assumes. It is subsequently realized that a manipulation of the system and an attempt to force the theorem to adapt is ineffective and impractical. Deeper analysis of the relationship between the coordinate plane and Pick's Theorem should be made; then, new ideas and theorems designed to exploit the advantages of this preexisting system should be derived.

Microbial Fuel Cells: A Novel Method of Transforming Potato Waste into Electricity. LISA MANNING (Notre Dame Academy, Covington, KY) Sr. MARY ETHEL PARROTT and Sr. JUDITH AVERBECK (Notre Dame Academy, Covington, KY)

The purpose of this experiment was to design a microbial fuel cell using common microorganisms and waste products. The cell generated electricity by using easily reduced "mediators" to scavenge electrons from metabolisms of microorganisms and deliver them to the electrodes, where potential differences were created. In Series A, one chamber was filled with yeast, glucose, and methylene blue, while the other chamber was filled with potassium ferriocyanide. The maximum current generated was 34.6 nA. Series B used pond water microorganisms and methylene blue to establish a control for the

experiments. The maximum voltage generated was 0.16 V. Series C was designed in the same manner except shredded potato waste was used as a substrate. Maximum voltages of 0.46 V were generated. Series D modified Series C to improve cell output. Series E had the same modifications except thionin replaced methylene blue. Both series D and E generated maximum voltages of 0.67 V. These results show that a microbial fuel cell using potato cell waste and pond microorganisms is a practical method of transforming waste products into electricity.

Power Algebras: Developed in Contrast to Linear Algebra. CHARLES R. MATHIS (Oconee High School, Watkinsville, GA)

Principal to linear algebra is the definition of linearity of a transformation, that for transformation T , $T(x+y) = T(x) + T(y)$ and $T(cx) = cT(x)$ for scalar c . A different pair of identities result when the operation of exponentiation is substituted for the multiplication operation and multiplication for the addition operation. This is an example of the problem undertaken, the development of such an "elevated" linear algebra, or power algebra, and contrast of the algebras and operations themselves. It is hypothesized that, should order-field components of variables be restricted to P of their respective fields, the algebra will begin to develop in almost precisely the same manner as linear algebra. It is, however, also hypothesized that all linear algebra concepts reliant on the commutativity of multiplication will not have closely matching counterparts in the new algebra. The procedure is to provide systematically altered definitions of those of linear algebra and to make mathematical deductions. Theorems are transformed and tested as conjectures to discern whether they apply 'in power algebra. Conversely, many propositions may exist in the power algebra but have meaningless, trivial, or false linear algebra counterparts. Then, one or more new, more dissimilar algebras are defined with different goals and the, new results analyzed. Contrasts of the relationship of exponents to multiplication compared to multiplication to addition are analyzed to attempt to find whether some new operation "higher" than exponentiation could be defined and utilized to "elevate" power algebra in a potentially limitless fashion.

A Pelton Wheel Turbine or a Propeller Turbine: Which Miniature Model Will Yield The Most Voltage Under Constant Water Pressure? FREDDY T. NGUYEN (Little Rock Central High School, 1500 South Park Street, Little Rock, AR 72202)

The goal of this project was to investigate which miniature model, a Pelton Wheel Turbine or a Vertical Propeller Turbine, would yield the most voltage under constant controls. A turbine transforms water's potential and kinetic energy into electrical energy with the use of a generator. The hypothesis stated that the Propeller Turbine, being a reaction turbine, would produce the most voltage. The Pelton Turbine was constructed using a plastic casing and spoons whereas the Propeller Turbine employed a circular casing, bars, and a "Y" connector. Both turbines utilized a wheel and a metal rod. Each turbine was connected to garden hoses, water nozzles, generators, and voltmeters. By turning the faucet knob in increments of 3/8 revolution, 3 revolutions per second (rps) of the Pelton Turbine and 3.375 rps of the Propeller Turbine were generated. The researcher recorded data 6 times for each increment of both turbines. The Pelton voltage produced from year 1 were: 0.73 V for 3/8 rev., 1.42 V for 6/8 rev., 2.10 V for 9/8 rev., 2.77 V for 12/8 rev., 3.43 V for 15/8 rev., 4.08 V for 18/8 rev., and 4.72 V for 21/8 rev. Year 2 of this project accumulated the means of the Propeller's voltage which were: 0.83 V for 3/8 rev., 1.62 V for 6/8 rev., 2.40 V for 9/8 rev., 3.13 V for 12/8 rev., 3.83 V for 15/8 rev., 4.58 V for 18/8 rev., and 5.32 V for 21/8 rev. The data for each increment of year 1 varied from 0.60-0.70 V and of year 2 from

0.70-0.83 V. The hypothesis was supported. Therefore, the Vertical Propeller Turbine is a better candidate for hydropower systems compared to the Pelton Wheel Turbine.

Is Physics the way to Cheat in Baseball? PAUL NIKODEM (Niles West High School, 5701 West Oakton Street, Skokie, IL 60077) Dr. RICHARD DECOSTER (Niles West High School, 5701 West Oakton Street, Skokie, IL 60077)

Prompted by the cheating scandals in baseball, an experiment was designed to determine if altered baseball bats were able to hit baseballs farther than an unaltered baseball bat. The hypothesis, inspired by the case of Albert Belle who was accused of corking his bat, was that there was a way to alter a bat so that it can hit the ball further. A number of baseball bats were obtained and holes drilled in all but one of them. These holes were filled with various materials, such as clay, cork, rubber balls, and sawdust. One bat was left hollow and one kept unaltered to be used as controls. A batting device with a spring to propel the bats with constant work was built, and this device was used to hit balls off a tee. The average distance that each bat hit the balls was compared, and from this, it was possible to infer that the hollow bat hit the balls significantly farther than the solid bats. This project is being extended to see whether balls hit some distance from the center of percussion of the bat travel farther when hit by aluminum bats than when hit by wooden bats.

The Use of Cyclopropyl to Prepare Dienes for Diels-Alder Reaction. ANNE ORGUNRINDE (Hillside High School, Durham, NC)

The purpose of this study is to examine if conjugated dienes will react with a dienophile to form useful adducts via Diels-Alder reactions. Ethyl acetoacetate was allowed to react with potassium carbonate and 1,2-dibromethane in dimethylformamide to produce methyl *i*-acetylcyclopropanecarboxylate. This will be converted into dienes for Diels-Alder reactions. The method using potassium carbonate as base and dimethylformamide as solvent did not yield a pure cyclopropyl derivative but overheating the reaction mixture resulted in an isomeric compound.

How Great are the Effects of Urbanization on Waterways? ANDRIA PARKER (Classen School of Advanced Studies, 1901 North Ellison, Oklahoma City, OK 73107)

The purpose of this project is to combine water quality research over three years to determine the effects of urbanization on waterways. To evaluate the waterways, thirty-five sites were chosen in Oklahoma City and were tested for levels of pH, dissolved oxygen, nitrate, ammonia, phosphate, and air and water temperatures. Macro-invertebrates were collected as biological indicators. An assessment of physical surroundings was determined by taking pictures of waterways in and around Oklahoma City and characterizing the appearance and location of them. The overall condition of the urbanized areas tested was found to be at an intermediate level. They were physically impacted, the macro-invertebrate populations were abundant but not at a desired variety, and the chemical testing showed slightly high levels of nitrate nitrogen and ammonia nitrogen. At sites that were profoundly impacted by urbanization the physical appearance was greatly impacted, the macro-invertebrates were sparse and showed little or no diversity, and the chemical tests showed higher levels of nitrate nitrogen and ammonia nitrogen. The sites that were largely non-urbanization showed little if any physical impact, had diverse macro-invertebrate populations, and did not have high levels of pollutants.

The Effects of Blade Geometry on Propeller Efficiency. MATTHEW G. PETRIE (John T. Hoggard High School, Wilmington, NC)

A propeller's thrust to weight ratio is very important to its energy efficiency. The purpose of this experiment was to determine the most efficient size, shape (diamond, rounded rectangle, or tapered), pitch (0°, 20° and 45°) and speed of a propeller. It was hypothesized that the most efficient propeller would be tapered, large, 45° pitch, and high speed. Propellers were constructed from balsa wood, twisted to the proper pitch using a jig and mounted on the shaft of a fan motor. Propeller speed was checked with a strobe light to insure that all propellers were rotating at the same speed. Testing was performed in a wind tunnel to isolate the air movement produced by the propellers and reduce external influences. It was found that a tapered, small, 45° pitch, propeller at high speed was most efficient. I believe small was a more efficient size because the blades of the large propeller vibrated, while the blades of the small propellers did not. These vibrations caused a disruption of the air flowing over the propeller and the resulting drag reduced the efficiency.

Are There Mathematical Correlations in Chimes? MICHELLE PHILLIPS (San Marcos High School, San Marcos, Texas) Dr. RONN PHILLIPS (Southeast Texas State University, San Marcos, TX 78666)

The purpose of this investigation is to be able to predict mathematically each length of tubing for a set chime. In Relief Society Homemaking Booklet, the researcher was given the lengths of pipes for twelve different chimes. The researcher took the lengths and analyzed the data as follows. The length of tubing for a particular note was divided by the next longer tubing length for a factor. The same length of tubing for the particular note was divided by the next higher tubing for that particular note. The researcher calculated the average of the two lists of factors. These factors were used to determine the length of a tube of higher pitch and a lower pitch. This was repeated four more times. After a sample set of chimes were made the researcher analyzed the pitch and lengths of the new chimes. The researcher concluded that there is a mathematical correlation between each length of tubing and the pitch in a chime.

Comparison of Rates of Solar Detoxification of Organic Environmental Toxins Using Capillary Electrophoresis and Gas Chromatography/Fourier Transform Infrared Spectroscopy. ERICA C. QUICK (Hillside High School, Durham, NC)

Competition for food between humans and other organisms has resulted in massive amounts of organic toxins in the environment. Several investigators have conducted studies to determine the effects of sunlight on environmental toxins. The purpose of this study was to determine if passive solar energy can detoxify toxins in the environment. During the first year of the study, solar detoxification of three pesticides (Atrazine, Carbofuran, and Trifluralin) was attempted using Capillary Electrophoresis/Micellar Electrokinetic Chromatography. The area counts of the individual pesticides were reduced with increased exposure to sunlight, however, it could not be determined if the pesticides were detoxified. Eight pesticides (Atrazine, Captan, Carbaryl, Carbofuran, Dicamba, Dichloran, Oxymal, and Trifluralin) were used during the second year study. Forty-five percent of the original pesticide concentration reacted with the sun for

four of the pesticides. It was concluded that Carbaryl, Dicamba, Oxyal, and Trifluralin were detoxified.

Median Coding, a Real-valued, Lossy Entropy Coder.
GEOFF SCHMIDT (Little Rock Central High School, 1500 Park Street, Little Rock, Arkansas, 72202)

Traditionally, data compression focuses on series of discrete symbols, that is, elements that may have one of a particular set of values, such as letters of the alphabet or arbitrary bytes. In the compression of multimedia data, such as sound and video, it is desirable to compress real elements, numbers which can assume any of a range of values. Median coding, such a compression algorithm, is presented. The mathematical basis for all data compression is Claude Shannon's rules of entropy, which give information content or "entropy" as a logarithmic function of probability. Median coding is a real-valued, lossy entropy coder. Given a number n , a precision requirement (in terms of allowable maximum error or mean error), a probability density function expressing the relative probability of different possible values of n , and optionally a bound on n , the median coder produces a bitstream that, fed to a median decoder, results in (1) a bound on the original n and (2) an approximation of n within the precision specification. Raising the precision requirement to get a more accurate approximation naturally increases the length of the bitstream. Median coding is optimal in terms of the amount of precision coded in each bit (but sometimes codes to more precision than requested), has bounded output time, is $O(n)$, and, with lookup tables, can be made essentially instantaneous. To test the median coder, simple lossy audio and still-picture compression programs were developed, using a delocalization transform (specifically the Fourier transform and discrete cosine transform, respectively) and fairly simple empirical probability models. Results were encouraging; the audio coder is fast (most processing time being devoted to the FFT) and, even without psychoacoustic modeling, roughly on par with ISO MPEG Layer 2.

Ink Removal During Paper Recycling Using Surfactants—A second year study of surfactant properties.

ELIZABETH SPENCE (Plano Senior High School, Plano, TX)

The purpose of my experiment was to determine which surfactant works best in the removal of ink from paper pulp. Two nonionic surfactant solutions were synthesized and used to remove copier and laser printer ink from paper. The solutions were 3% NaCl and 1% surfactant E or F in water. Both surfactants were tested just below their cloud point where detergent properties are maximum. One hundred sheets containing each type of ink were printed and made into pulp. The surfactant solution and pulp were added to a tank and sparged with air. The tank with surfactant solution F was kept between 65.5 and 71.1°C. The tank with surfactant E was kept between 21.1 and 23.8°C. The air injected into the pulp slurry generated foam. As the bubbles traveled to the surface, they carried the paper fibers and left the ink particles behind. The foam was skimmed off into a bucket and left to decay. The pulp left in the bucket was rinsed. Any ink that floated to the surface was removed. Processed pulp was made into paper and the concentration of remaining ink particles was measured relative to the starting concentration. Both surfactants were effective in removing copier and printer ink, although surfactant E removed less of the printer ink. The surfactants were most effective at removing the smallest ink particles. Processing the pulp was easier at the higher temperature used with surfactant F.

Induced Oxide Formation on Thin-film Silicon Nanocrystallites Expressing Fabry-Perot Fringes. ANDREA R. TAO (Torrey Pines High School, San Diego, CA), KEIKI-PUA DANCIL and Dr. MICHAEL J. SAILOR (Department of Biochemistry and Chemistry, University of California, San Diego, La Jolla, CA)

The photoluminescence of porous silicon was discovered in 1990, causing a great stir in the scientific community due to its possible applications in electronic and photo optic devices. The material is created through an electrochemical etching process, producing arrays of Si nanocrystallites. Under modified conditions, a thin uniform layer of nanocrystallites can be attained. Such samples display peak patterns in their reflectance spectra collectively known as Fabry-Perot fringes. Rapid aging of these samples was simulated in experiments that were conducted to determine whether the formation of an oxide layer on the porous surface affected the structure of the fringes. Different samples of Boron-doped crystalline silicon, with an approximate resistivity of 3-5 $\Omega\text{-cm}$, were etched in a single-compartment, two-electrode Teflon electrochemical cell with a platinum wire counter-electrode. The etching reaction was carried out in an aqueous hydrofluoric acid/ethanol solution run at 40 m^2/cm^2 for 2 minutes. To thermally induce the growth of oxide, samples were heated in a furnace at a constant temperature of approximately 200°C in air for various increments of time. To measure the growth of the established oxide layer, infrared spectra of the samples were taken periodically using a Fourier Transform infrared spectrometer. Similarly, reflectance spectra were taken with a charged-coupled device (CCD) photo detector to determine the relative changes in the fringe pattern. Spectra were analyzed using computer methods and the measured fringe spacing changes were converted to changes in apparent optical thickness. As the oxide layer increased in samples, the optical thicknesses decreased in a rough exponential curve, indicating that the presence of silicon oxide species altered the refractive index of the nanocrystallite media. Results of this experiment should aid in the better understanding of the behavior of porous silicon samples displaying Fabry-Perot fringes, benefiting any future applications of the novel material as chemical sensors or optical components.

Continued Fractions Related to Gauss Maps.

ELEANOR E. WILLIAMS (Palos Verdes Peninsula High School, 27118 Silver Spur Road, Rolling Hills Estates, CA 90274) SLOBODAN SIMIC (Department of Mathematics, University of Southern California, Los Angeles, CA 90007)

Continued fractions and the Gauss Map, a chaotic dynamical system, are related. First, an equation was found to demonstrate this relationship. We prove that the Gauss Map and the shift map of symbolic dynamics are conjugates, which results in an elegant, alternate proof that the Gauss Map is chaotic. We define and explore complex continued fractions. Theorems about their convergents are proven, and an approximation proposition is made. We create analogous complex Gauss Maps, prove that they are chaotic, then determine for what points the maps are periodic. Finally, we create and explore a geometrically modified Gauss Map, or Geo-Gauss Map. [Supported by Southern California Academy of Sciences' Research Training Program]

A Study of the Eclipsing Binary Variable Star, Beta Lyrae. SCOTT L. WISOR (Cherry Creek High School, 8300 East Union Avenue, Englewood, CO 80112)

The purpose of this study was to find the period of the binary eclipsing star, Beta Lyrae. The period is the time between two primary eclipses that result in a dimming of the light from the

star. These eclipses occur when the secondary star eclipses the primary star. It is suspected that the period of this star is increasing which would indicate that orbital changes are occurring in Beta's system. Beta was studied with a 5 inch Schmidt Cassegrain telescope equipped with blue and visual filters, an EBM computer, EDC and SBIG digital camera and analysis software, and an Electrim 1000 TE Digital camera. Beta is redder during primary minima than at any other time. This was concluded from data recorded in the blue and visual filters, which yield a color index. A period of 12.84 days was first reported in 1784 and a period of 12.93784 days was reported in 1993. This study found Beta's period to be 13.15 +/- 0.1 days. The period has been reported to increase by approximately 9 seconds per year. The value of 13.15 days obtained in this study is consistent with the hypothesis that Beta Lyrae's period is increasing, but is probably too large. The lack of accuracy can be largely attributed to the gaps in the data that were gathered. In future studies, an equivalent or greater number of observations should be gathered over a short period of time. Analysis of the uncertainties in the result of this study suggests a +/- error of approximately 0.1 days, which excludes the period measured in 1784 and suggests that the period has also increased since measured in 1993.

A Study of the Aroma Esters and the Interaction of the Olfactory System. DANIELLE WOODS (Sumner High School, 4248 Cottage, St. Louis, MO 63113)

The literature reports that chemists combine natural and synthetic compounds to prepare artificial flavorings that can closely reproduce natural flavors. Many fruits, flowers and spices contain esters that contribute to their characteristic flavors. Such esters make up the basic repertoire of flavor chemists. The esterification is accomplished by reacting a carboxylic acid with an alcohol. This reaction is an addition/elimination reaction which exploits the reactivity of the anhydride. The esters that will be synthesized will be used in the study of the olfactory system. Molecules produce a smell if they interact with a protein molecule in the olfactory nerve ending, modifying its shape and thus a kind of lock and key mechanism. A given molecule of a particular shape can interact with a given protein molecule so long as the odorant matches the shape of the protein receptor. This theory is a difficult one to prove because they are approximately 30 types of anosmia which suggests that there are at least 30 different locks than can be assessed. The synthesis of the esters will be summarized and the results will be given.

Iron Mineral Characterization of Deep Sea Sediments Using Sequential Chemical Leaching Techniques. RENA YI and RICHARD SCHWARTZ (Torrance High School, Torrance, California) MARTHA SCHWARTZ, DOUG HAMMOND, and STEVEN P. LUND (Department of Geological Sciences, University of Southern California, Los Angeles, CA)

Sediment cores collected from the Blake/Bahamas Outer Ridge exhibit anomalously high magnetic intensities in the carbonate-rich Holocene age-surface sediments relative to lithogenic sediments from the earlier glacial stage. Similar conditions are seen in cores sampling ¹⁸O stage 5e, the last time the earth was as warm as it is today. To investigate this counter-intuitive observation, we examined the relationship between sediment horizon and iron mineral abundance's by conducting sequential leaching experiments on various samples, using three reducing agents that should solubilize different minerals containing ferric iron: hydroxylamine hydrochloride, sodium dithionite, and ammonium oxalate. In this sequential scheme, hydroxy-

lamine should have extracted ferrihydrite and lepidocrocite, and dithionite should have extracted goethite and hematite, leaving only magnetite for oxalate. The resulting leachates were analyzed by atomic absorption spectroscopy. Less iron is extracted with oxalate than with hydroxylamine; concentration of magnetite appears to be low. Possible matrix effects were proven negligible. The results document chemical reactions that occur as the sediment is buried, which produce particular Fe minerals at the expense of others. Data suggest that ferrihydrite and lepidocrocite deposited during the glacial times were subsequently dissolved and redeposited as goethite (or hematite?) in the interglacial surface sediments. Similar measurements have been done on sediments from the last glacial termination. The Fe concentration signal correlates well with the susceptibility, revealing two dithionite and hydroxylamine hydrochloride spikes between 1480-1490 cm and 1530-1550 cm. Hematite and goethite may have been similarly reprecipitated by redox reactions in the sediment at the time of the last glacial termination. [Supported by the SCAS RTP Program]

Software Functionality Comparison Between Somatron Plus Software and NIH Image Software.

ROBERTO YOUNG (Sumner High School, 4248 Cottage, St. Louis, MO 63113)

High resolution medical Magnetic Resonance Image (MRI) and Computed Tomography (CT) scans of the human brain are typically viewed as slices reconstructed into axial, sagittal or coronal gray scale images. These slices may be further reconstructed into 3-D models using advanced computer image processing techniques. Generally, the sophisticated software for the Somatron Plus Medical CT scan computer manipulate the data sets derived from 2-D tomographs. In previous research, these 3-D data sets have been successfully transferred from a medical computer to a classroom computer through the utilization of NIH Image software. The goal of this project is to determine quantitatively the degree of effectiveness of NIH Image software as compared to the Somatron Plus medical software.

The Effects of Rb Mutation in Tumorigenesis. JAKE YOUNGBERG (Cherry Creek High School, 9300 East Union Avenue, Englewood, CO 80111) Dr. CARL HILLIKER (Colorado University Health Sciences Center, Medical Oncology, 4900 East 9th Avenue, Denver, CO 80262)

Cancer is one of the most common causes of death in the United States. The gene Rb is known in humans to work as tumor suppressors, and many tumors contain mutations of both genes. Rb is known to suspend cell growth if the cell has sustained genetic damage, so that the damage may be repaired. However, it is not known how these genes function and what role they play in the prevention of cancer. Several theories exist as to the function of Rb. The purpose of this experiment is to test the hypothesis that the loss of Rb is required in pituitary, thyroid, islet cell, pineal blastoma, and lymphoma cancer types, and that the loss of Rb is not required but increases the chance of a sarcoma, angiosarcoma, and sarcomasarcoma. Also, this experiment will observe what tumors are associated with the loss of the Rb as well as to possibly find a tissue that has lost the gene but does not develop cancer. This will provide a greater understanding of the tumor pathway and reiterate other studies in this field.

Reading Enhancement System. PAUL J. ISKANDER and JONATHAN ZELNER (Academy for the Advancement of Science and Technology, Hackensack, NJ)

In the United States alone 1.5 million people suffer from some form of vision loss. The Reading Enhancement System (RES) is a computer program designed to aid those who are experiencing mild to moderate visual disability. These conditions can be the result of various afflictions including macular degeneration, glaucoma, cataracts, etc. In order to do this RES first compensates for the loss of visual acuity by magnifying the given image by a user defined amount. In addition, RES has the versatility to be used in many different situations. For those who want to play musical instruments, RES can support various forms of input, such as a foot pedal connected to the serial port of a computer. RES not only magnifies the image or text it receives, but manipulates it for usage in a situation in which the operator of the program may not be able to access the computer in a traditional manner. Furthermore, RES allows hands free operation by scrolling the image across the screen at without user intervention. In addition to this RES also provides a variety of presets that provide for varying line height, document size and types of media (i.e. photographs, sheet music, newspaper, etc.).

The Stability of Different Fin Configurations in Model Rockets Phase Two: A Study of a Surface Area. NATHAN STUCKEY (North Davies High School, Elmore, Indiana)

The purpose of my project is to find the most stable fin pattern in a model rocket. The information I obtain can be used in the design of larger rockets. I built four model rockets with the same fin configuration. The only difference between the rockets was that the fin surface areas were different. I then tested the stability of the rockets using a wind tunnel. I deviated the course of the rocket until it would no longer recover. I took the arcsin of the distance the nose cone moved divided by the distance between the nose and pivot point of the rocket. My project seemed to show that increased surface area in the rear of the rocket increased stability, but that the added stability was not feasible when compared to the size of the fins. I plan to continue this project by figuring out the impact of increasing the number of fins but not surface area.

Paleoecology and Taphonomy of a Middle Ordovician Edrioasteroid Firmground, Central Kentucky. NICK GARLAND (Bell County High School, Pineville, KY) DR. FRANK K ETTENSOHN (Department of Geological Sciences, University of Kentucky, Lexington, KY)

This research details the plight of a Middle Ordovician community that was rapidly buried and subsequently fossilized in the Sulphur Well Member of the Lexington Limestone near Danville, Kentucky. Of major concern in this community is a group of extinct echinoderms known as edrioasteroids. These relatively small animals lived as epifaunal filter feeders, primarily on brachiopod valves atop marine firmgrounds and hardgrounds. The edrioasteroid in the study, *Cystaster stellatus*, largely used the shells of the brachiopod *Rafinesquina "alternata"* as its substrate and occurs in such great numbers on this firmground as to enable a study of its paleoecology and taxonomy. The disarticulated, convex-up position of most *Rafinesquina* valves suggests that the valves were transported to the locality, because the living animal is normally bivalved and lives in a convex-down position. *C. stellatus* demonstrate a marked tendency to cluster near the elevated central portion of the brachiopod shells, presumably to elevate themselves higher in the water column. If the brachiopods had been alive at the time, it is more likely that the edrioasteroids would have congregated near the margins of the shells where

food-rich waters were being drawn into the shells. This evidence suggests that the edrioasteroids colonized the firmground to gain a feeding advantage shortly after the dead, disarticulated brachiopod shells were transported onto the surface. The fact that so many edrioasteroids are well preserved on this surface indicates rapid burial by fine-grained sediment as a result of storm movement. Hence, preservation of this surface allows a glimpse into an instant of geologic time of an extremely rare sea-bottom community — a Middle Ordovician edrioasteroid firmground.

Social Sciences February 13, 1998 3:00-5:00pm

Accuracy of Fat Content on Package Labeling in Varieties of Ground Beef. AMBER D. BARNES (Gage High School, Box 19, Gage, OK 73843)

This project determined the fat contents of ground round, extra lean, ground chuck, super lean, and regular ground beef using the Modified Babcock Test (MBT). Multiple samples of beef from 4 stores were obtained. Fifteen ml of sulfuric acid and 10 ml of hot water were added to 9 grams of meat. Bottles were shaken to dissolve meat and release the fat. They were then whirled in a centrifuge, and additional hot water was added to aid in the rising of the fat. After the fat settles to the 50 ml mark on the test bottle, measure the fat content and convert to percent of fat. The leanest ground beef product was super lean, second was ground round, third was ground chuck, fourth was regular, and last was extra lean. Super lean was the only meat that met USDA requirements. According to the MBT, super lean contained 0.5% less fat than required by USDA. The other four types of ground beef exceeded USDA requirements of fat content. Ground chuck exceeded USDA requirements by 3.6%, ground round by 5.3%, regular by 6.7%, and extra lean by 31.8%. The best buy of lean beef per lb. of product was ground chuck, followed by ground round. The third best buy was super lean, followed by regular and extra lean. Regular ground beef and extra lean were least economical and had equal averages of fat content. Ground round is the best choice both economically and health wise.

Investigation of the Age of the Great Sphinx. BIONGO BOSUKU (Summer High School, 4248 Cottage, St. Louis, MO 63113)

For years, traditional Egyptologists have assumed that the great pyramids at the Giza plain in Cairo, Egypt and the Great Sphinx in the same location are the same age. However, due to evolving methods of archeology and technological advances in Subterranean and satellite imaging, there are now data that suggest that the Great Sphinx is older than the pyramids. This project will explore this new data and these new scientific tools in order to determine as accurately as possible, the true age of the Great Sphinx.

The Development of Responses to Questions: A Comparison of English and French. JULIA EINBOND (Horace Mann High School, Bronx, NY)

At an early age, children recognize the need to respond to questions posed directly to them. The acquisition of appropriate response forms, however, is a more gradual process. This process of acquisition was studied in two children: one native English speaker and one native French

speaker, both of whom were in their early twos at the onset of the study. By calculating the frequency of different types of responses in each child's speech, their abilities to form more complicated and correct responses were seen to progress in stages. Over the course of approximately 1.2 years, the recorded response evolved from non-informational repetition to original, appropriate, and grammatically correct responses. Comparison of the responses in both languages indicates that the stages of response development are not language-specific.

The Effects of a Gerontological User-Friendly Computer Network on Computer Anxiety and Depression. BRIAN M. THOMPSON (Westmoore 1-high School, Oklahoma City, OK)

Depression occurs in many elderly adults around the age of 80. The cause of this problem seems to be lack of human interaction. Previous research indicates that involvement with others aids in depression. It is also difficult to find ways to entertain the elderly community. The purpose of this experiment was to analyze the effects of an online service on depression, entertainment, and computer anxiety. The results of this research showed that with the use of America Online(tm) the elderly adults seemed happier, and showed great enthusiasm towards computers.

Modeling Future Population Growth and Trends. ERIC M. WU (Case Western Reserve University, Cleveland, Ohio 44106)

Population growth has quickly become a global issue with the development of problems dealing with food shortage, housing, and carrying capacity among others. It took humanity perhaps 1,000,000 years to reach 1 billion people, 120 years to reach 2 billion, 30 years to reach 3 billion, 15 years to reach 4 billion, 12 years to reach 5 billion, and only 11 years to reach 6 billion. This staggering rate of growth brings about the need for predicting future population rates and totals to solve problems. A computer population model for this purpose was created using GLOBESIGHT (Global Foresight), which is a tool that helps the user reason about the future on various global issues. The model, which consists of mathematical equations, was written in FORTRAN language on a Sun work station. The model itself is split into three levels. The first sub-model gives a rough estimate of population figures by inputting one variable, the population growth rate. The second sub-model calculates the population growth rate using the two input variables of birth and death rates. Finally, the third level can calculate birth cohorts, death cohorts, population cohorts, population growth rate, and the total population using information about mortality and fertility. Using the newly created population model, the effects of changing variables on population growth in different regions, countries, and continents was studied. Two case studies were conducted involving the most populous country and a comparison of developing and developed regions. Perhaps the most intriguing result was the fact that India is poised to surpass China in total population. Also, barring any change in the trend of population growth rate, the developing regions will comprise an estimated 7/9 of the world population by 2035.

Education

February 13, 1998 3:00-5:00pm

Effects of Computer Use on Mood, Math Performance, and Reading Comprehension. KEVIN BOGLE (Classen School of Advanced Studies, Oklahoma City, OK)
Dr. KATHLEEN DONOVAN (University of Central Oklahoma)

The current study measured the effect of computer use on positive and negative moods, math performance, and reading comprehension of 30 college students on two equal forms of three standardized tests. It is important to determine if students are able to spend time playing on computers without negative side effects. Three instruments were selected to determine if playing on computers would affect mood, math, or reading performance. Students were tested on their moods with the Positive and Negative Affect Scale (PANAS). This instrument tests both positive and negative mood changes as participants rate how much they are experiencing 20 different mood adjectives (10 positive; 10 negative). One form of the Nelson-Denny Reading Test was then taken in a quiet classroom to determine students' reading comprehension. Next the Wide Range Achievement Test-Arithmetic was given to the students to see what their math skills were. Each form of the test took fifteen minutes. After all 3 instruments were completed students were allowed to play their choice of games on a computer for 30 minutes. Afterwards all of the students were again tested with alternate forms of all 3 instrments. The results indicated that students negative moods were significantly affect. Although college students thought that playing on the computer had put them in better moods, the results were just the opposite. Playing on the computer dulled their affect. Their math performance was slightly worse after playing on the computer, but reading comprehension scores were the same. Apparently, students are able to play on the computer without a significant loss to their performance, however, they were in significantly less negative moods after computer use.

Memory— A Five-Year Study: Do Mnemonic Techniques Improve Learning? KELLY A. FLETCHER (Union County High School, 1000 South Lake Avenue, Lake Butler, FL 32054)

This research was conducted to determine the effectiveness of using mnemonic techniques to increase the short-term memory capacity of educable mentally handicapped, learning disabled, academically average, and academically motivated students. Five students in each target group from three age groups (7-10, 11-14, 15-18) were randomly selected. The short-term memory capacity of each student was determined using three measures: serial recall, free recall, and forced-choice recognition tests. Items to be remembered were presented three separate ways for each type of test: auditory, visual, and utilizing mnemonics. Results of this experiment indicate that mnemonics improve the short-term memory capacity of all target groups regardless of the students' mental abilities and auditory and visual strengths/weaknesses. Based on the results of t tests, it was concluded that these mnemonic memory span increases are most likely not due to chance (95% significance level). It can be assumed that the sample results would hold true for the population mean.







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