

# SCAS

South Carolina Academy of Science



# 2013 MEETING PROGRAM

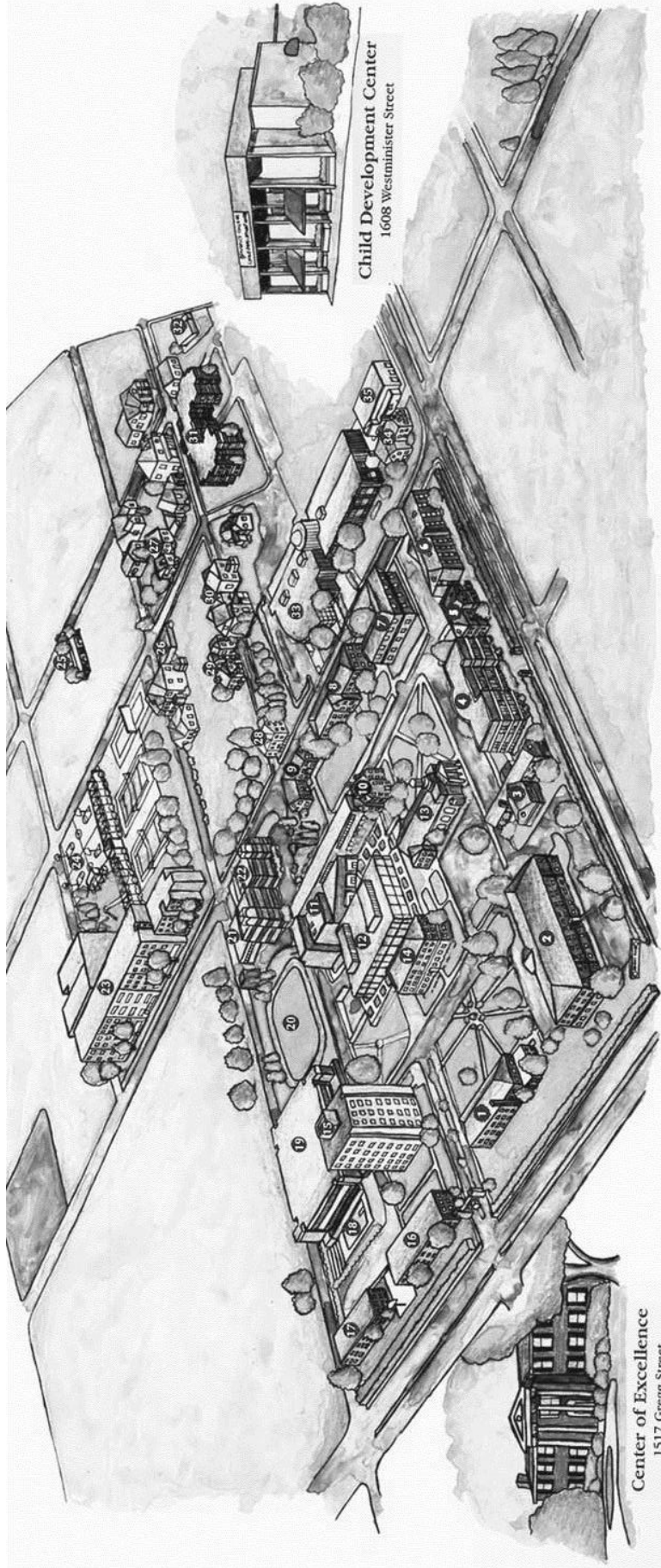
SOUTH CAROLINA ACADEMY OF SCIENCE  
EIGHTY-SIXTH ANNUAL MEETING

SOUTH CAROLINA JUNIOR ACADEMY OF SCIENCE



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- 1 Baccoats Hall
- 2 Alumni Hall
- 3 Stokes Center
- 4 Administration Building
- 5 Pratt Hall
- 6 Gambrell Hall
- 7 Mini Dormitory

- 8 Stuart Hall
- 9 Antislidel House/President's Residence
- 10 Morgan Hall
- 11 Henry Ponder Fine Arts/Humanities Center
- 12 Benjamin F. Payton Learning Resources Center

- 13 Antislidel Chapel
- 14 Duckett Hall
- 15 Muller Hall
- 16 Jenkins Hall
- 17 Goodson Hall
- 18 Swimming Pool
- 19 Benjamin Mays Human Resources Center

- 20 Recreation Field
- 21 McKim Energy Plant
- 22 Parking Facility
- 23 Oak Street Honors Dormitory
- 24 Community Recreation
- 25 Baccoats Apartments
- 26 Army ROTC Department

- 27 Football Operations House
- 28 Staff Residence
- 29 Faculty Residence
- 30 Faculty/Staff Residence
- 31 Haskell Avenue Dormitory
- 32 Community Development Center
- 33 David H. Swinton Campus Center

- 34 Gressette Leadership Center
- 35 Health and Fitness Center

## Table of Contents

	<u>Page</u>
<b>Welcome from SCAS President-Elect Pearl Fernandes</b>	<b>2</b>
<b>Schedule of Events (Meeting Schedule)</b>	<b>4</b>
<b>Plenary and Keynote Speaker Biosketches</b>	<b>5</b>
<b>Governors Awards</b>	<b>7</b>
<b>Dwight Camper Undergraduate Award</b>	<b>11</b>
<b>SCAS Topical Sessions (Senior Academy Oral Presentations)</b>	<b>13</b>
<b>Poster Presentations</b>	<b>19</b>
<b>SCAS Abstracts</b>	<b>22-45</b>
<b>SC Junior Academy of Science (SCJAS)</b>	<b>46 – 124</b>
SCJAS Meeting Schedule	46
SCJAS Awards Ceremony Schedule	47
SCJAS Judges	48
SCJAS Oral Presentation Sessions	49 - 64
Regional Science Fair Winners Poster Session	65
SCJAS Abstracts (Alphabetical by first author)	67 - 124
<b>South Carolina Academy of Science 2014 Meeting</b>	<b>Inside back cover</b>
<b>Sponsors</b>	<b>Please see the Program Cover and Back cover</b>

**Welcome to the South Carolina Academy  
of Science  
2013 Annual Meeting**

Dear, Students, Teachers, Fellow Scientists  
and Colleagues,

Good morning everyone. Let me please introduce myself. I am Dr. Pearl Fernandes, President- Elect of the South Carolina Academy of Science (SCAS). I am a Professor in the Biology Department at USC Sumter. On behalf of the South Carolina Academy of Science it is my pleasure to welcome you to the 2013 Annual Meeting here at beautiful Benedict College. For those who are new, SCAS is a state-wide, interdisciplinary science organization established in 1924. Members include college students, grade school and college faculty, educational administrators, and related professionals in business and government including SRS. The Academy sponsors the South Carolina Junior Academy of Science (SCJAS) that introduces high school students to the scientific community by providing them opportunities to present original research. The SCAS meetings provide a critical forum for networking among its members. SCJAS has a current membership of over 2500 student members and 100 affiliate science clubs.



The theme of this conference, "Health Challenges: Raising the Bar" emphasizes the significant strides made in this field, and the need for improved research and collaborations to further advance health outcomes in South Carolina. Healthcare was, and continues to be the underlying foundation discipline behind much of the current biotechnology revolution. The State of South Carolina has made great strides in this area thanks to the efforts of both academia and industrial collaboration. The SCAS is excited about the future and would like to foster the growth of this industry along with development of a skilled workforce in health care, engineering and innovative technologies.

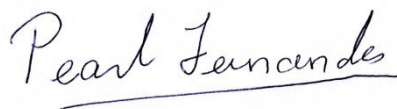
We are excited that over 500 students, faculty, teachers, and scientists in biology, chemistry, physics, astronomy, engineering, mathematics, health science and more, working in academia and industry are participating in this year's event and sharing their exciting discoveries through presentations, workshops, and poster sessions. We are honored to have two distinguished plenary speakers, Dr. Saundra Glover, Director of the Institute for Partnerships to Eliminate Health Disparities (IPEHD), who will share her research on "Health Equity in the 21st Century: Saving the Next Generation through Research, Education, and Community Engagement" and Dr.

Melissa Moss, Undergraduate Director of the University of South Carolina's Biomedical Engineering Program, who will present on "Insights into Alzheimer's Disease" and discuss the role of engineers in medical research. Today, I invite you to create a memorable, highly- educational experience of the 2013 Annual South Carolina Academy of Science Meeting and establish networks and collaborations for future professional and personal growth.

These events do not happen by themselves, so I want to first thank all our sponsors and donors for their generous support of this Meeting. We sincerely thank Benedict College and its faculty, especially Dr. Samir Raychoudhury and Professor Vivian Counts, for their great hospitality and support for the meeting. Many thanks to the dedication and efforts of volunteers and most importantly our current Academy President, Dr. Robin Brigmon, and Councilors, especially Dr. Bill Pirkle, Dr. David Ferris, Dr. Tom Reeves, Dr. Justin Wyatt, Dr. Lucia Pirisi-Creek, Dr. Edna Steele and Professor Tammy Taylor, along with several others who have strived to make this meeting a success.

A very special thanks to all of you students, mentors, teachers, parents, scientists and volunteers who have worked so hard to make our Academy the caring, engaging and exciting organization it is today. We truly value your active participation as we are here for you.

Have a great day,

A handwritten signature in cursive script that reads "Pearl Fernandes". The signature is written in black ink and is underlined with a single horizontal line.

Pearl Fernandes, Ph.D.  
President-Elect, South Carolina Academy of Science

## SCHEDULE OF EVENTS

### Saturday, April 13th

<b>7:30 AM - 1:00 PM</b>	<b>SCAS &amp; SCJAS Registration</b>	<b>Antidel Chapel &amp; Vestibule</b>
<b>8:30-9:00 AM</b>	<b>Welcome</b> Dr. David H. Swinton, President, Benedict College Dr. Prakash Nagarkatti Vice-President for Research, USC Dr. Samir Raychoudhury, Dean, STEM, Benedict College	<b>Antidel Chapel</b>
	<b>Introduction of Plenary Speaker</b> Dr. Pearl Fernandes USC Sumter, President-Elect SCAS	
<b>9:00–9:30 am</b>	<b>Plenary Speaker</b> Dr. Saundra Glover Director for Institute for Partnerships to Eliminate Health Disparities, USC	
<b>9:45 AM - 12:30 PM</b>	<b>SCAS Oral Presentation Morning Sessions</b>	
Chemistry and Biochemistry		Benjamin E. Mays Human Resources Ctr. Rm.131
Biology & Environmental Sciences		Benjamin E. Mays Human Resources Ctr. Rm 132
Molecular Biology		Benjamin E. Mays Human Resources Ctr. Rm 133
Medicine, Pharmacy & Public Health		Benjamin E. Mays Human Resources Ctr. Rm 134
Physics and Astronomy		BC Cares Building Rm POA
Mathematics & Computer Science		BC Cares Building Rm POB
<b>9:45 am-1:30 pm</b>	<b>Poster Presentations (SCAS and SCJAS)</b> in BC Cares Arena (basement floor) of Benjamin Payton LRC building	
<b>11:45 am-1:30 pm</b>	<b>Lunch</b>	<b>Henry Ponder Fine Arts/ Humanities Ctr. Lobby</b>
<b>1:30-2:00 pm</b>	<b>Introduction of Plenary Speaker</b> Ms Vivian Counts, Benedict College	<b>Antidel Chapel</b>
	<b>Plenary Speaker</b> Dr. Melissa Moss, Department of Chemical Engineering, USC	
<b>2:00-2:30 pm</b>	<b>Awards Presentation</b> Governor’s Awards Presentation Dwight Camper Award Presentation	<b>Antidel Chapel</b>
<b>2:30-3:00</b>	<b>Afternoon Break</b> Sponsored by NASA Space Grants Consortium	<b>Henry Ponder Fine Arts/ Humanities Ctr. Lobby</b>
<b>3:00-3:30 pm</b>	<b>Undergraduate Awards Presentation</b>	<b>Antidel Chapel</b>

## Plenary Speakers

### **Saundra Glover Ph.D., Professor**

*Associate Dean for Health Disparities and Social Justice, Arnold School of Public Health;  
Associate Director, SC Rural Health Research Center and Director, Institute for  
Partnerships to Eliminate Health Disparities, University of South Carolina*

Dr. Glover received her B.A. in the Department of Accounting, SC State College, and her Ph.D. in Management and Organizational Behavior at the University of South Carolina. She began her academic career as an Assistant Professor at the University of South Carolina in 1991. In 2005-06, she served as Vice President for Research and Economic Development at SC State University. She returned to USC in July, 2006, and soon thereafter was promoted to Full Professor.

Dr. Glover established the Institute for Partnerships to Eliminate Health Disparities at the University of South Carolina in 2006. The mission of the Institute is to eliminate health disparities through community, academic and other strategic partnerships in South Carolina and beyond. With support from funding sources such as the Kellogg Foundation and the National Institute on Minority Health and Health Disparities, the Institute has provided and continues to provide tremendous opportunities for training and research in Health Disparities, in South Carolina and across the State. Dr. Glover leads the Coordinating Center of Excellence in the Social Promotion of Health Equity through Research, Education, and Community Engagement (CCE-SPHERE), a collaborative venture with Claflin University funded by the NIH, focusing on HPV-mediated cancer and HIV with research projects, training and community outreach programs.

### **Dr. Melissa Moss**

*Department of Chemical Engineering, USC*

Dr. Moss received her doctoral degree in Chemical Engineering from the University of Kentucky and completed postdoctoral training in Biochemistry and Neuroscience at the Mayo Clinic School of Medicine in Jacksonville, FL. She joined the Chemical Engineering faculty at the University of South Carolina in August of 2004, and she now also serves as a core faculty member and Undergraduate Director for the Biomedical Engineering Program. Dr. Moss' research interests are in the area of protein aggregation in Alzheimer's disease. She has published more than 20 papers in



high impact journals including Biochemistry, Molecular Pharmacology, and the Journal of Neurochemistry. As a graduate student and postdoctoral scholar, Dr. Moss was a National Science Foundation Graduate Research Fellow and an American Heart Association Postdoctoral Research Fellow. As a faculty member, Dr. Moss has been the recipient of a National Science Foundation Faculty Early Career Development (CAREER) Award, a New Investigator Research Grant Award by the Alzheimer's Association, and a Beginning Grant-In-Aid from the American Heart Association. Most recently, she is funded as part of a National Institutes of Health Center of Biomedical Research Excellence (COBRE) Award. Dr. Moss received an Excellence in Teaching Award from the University's Mortar Board Society in 2007 and was recognized by the University as a Distinguished Undergraduate Research Mentor Award in 2011. In addition, she was named a 2010 Rising Star by the University and is the recipient of the 2012 Governor's Young Scientist Award

The South Carolina Academy of Science gratefully recognizes the contribution of  
**MeadWestvaco, Michelin North America, and the  
South Carolina Research Authority**  
for their support of the  
**Governor's Awards for Excellence in Science**  
1985-1988 Drug Science Foundation Award for Excellence in Science  
1989-Present Governor's Award for Excellence in Science

The award was established in 1985 by the Drug Science Foundation to honor specifically an individual or team within the state whose achievements and contributions to science in South Carolina merit special recognition and to promote wider awareness of the quality and extent of scientific activity in South Carolina. Since 1989 the award, named the "Governor's Award for Excellence in Science", has been under the joint sponsorship of the Governor's office and the South Carolina Academy of Science. In 1993 these groups were joined by the Dewees Development Corporation and Harbor Watch of Charleston. In 2004 **MeadWestvaco** became sponsor of the awards, in 2005 **Michelin North America** joined, and this year the **South Carolina Research Authority** joins in sponsorship of the Governor's Awards.

Beginning in 1990, two of these awards were given annually to include an award for scientific discovery and/or an award for scientific awareness. In 2005 the Academy, in conjunction with the Governor's Office, initiated the sponsorship of a third award directed to a gifted young researcher (*only those individuals who have completed no more than 12 years beyond the Ph.D.*). The award is called the Governor's Young Scientist Award for Excellence in Scientific Research and was sponsored by Michelin North America. The awards are presented to the recipients at a special awards ceremony held in the spring in conjunction with the South Carolina Academy of Science's annual meeting.

Candidates should be currently working in South Carolina or have conducted a substantial portion of their work within the state. Contributions may be in any area of science and may be for service to science through non-formal education in the various media, for exemplary exposition at the college or university level, or as an acknowledgement for significant outstanding formal research. The award may be given to an individual or a team. If the award is made to a team, the honorarium will be distributed equally.



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## **2013 Governor's Award for Excellence in Scientific Research**

is awarded to

### **Rosalie Crouch Medical University of South Carolina**

Dr. Crouch received her Ph.D. in Organic Chemistry from the Belfer Graduate School of Yeshiva University in 1972. After serving in a postdoctoral position at Columbia University she came to the Medical University of South Carolina in 1978 as Assistant Professor of Ophthalmology and Biochemistry. She quickly rose through the faculty ranks and was promoted to Professor of Ophthalmology and Biochemistry in 1982. Currently she is a Distinguished University Professor. Dr. Crouch held a number of administrative appointments at MUSC including Associate Dean and Dean of the College of Graduate Studies; Associate Dean for Research for the College of Medicine; Associate Provost for Research, and Provost and Vice President for Academic Affairs of the University. Under her leadership, MUSC rose rapidly from a small amount of competitive extramural funding to one of the very best free standing academic health science centers in the world.

Dr. Crouch spent her entire scientific career in the state of South Carolina. She is described by her colleagues as the preeminent scientist in her field of vision research. Her scientific discoveries in the field of vision research have led to dramatic advancements in understanding the role of retinoids, the molecules initially responsible for the detection of light, in visual health and disease. Dr. Crouch has published over 200 full length manuscripts, most of which were communicated in outstanding journals. The importance of her work has been highlighted by her appointment to the Board of Scientific Counselors of the National Eye Institute, by being designated as a Senior Scientific Investigator of Research to Prevent Blindness, by being named as a Counselor of the American Society for Photobiology, by serving as principal investigator of a longstanding and highly productive National Institutes of Health grant (currently in its thirtieth year), and by the receipt of an NIH Special Career Achievement Award.

## **2013 Governor's Young Scientist Award for Excellence in Scientific Research (Co-recipients)**

is awarded to

### **Frank Chen University of South Carolina Columbia**

Dr. Chen received his Ph.D. from the Georgia Institute of Technology in 2001. After serving as Senior Staff Engineer at United Technologies Research Center, he accepted a faculty position at the University of South Carolina in 2007, where he now is an Associate Professor in the Department of Mechanical Engineering. Prof. Chen is best known for his contributions to advanced materials synthesis, characterization for energy systems, and separation membrane applications. He has published extensively in prestigious journals in the materials and energy field, publishing more than one hundred peer reviewed archival or journal articles, and has built a widely recognized research group and laboratory at USC.

Dr. Chen has been a key contributor to the success of the SmartState Solid Oxide Fuel Cell Center (SOFC) of Economic Excellence. The SOFC has generated 271 new jobs and has engendered over \$34M in total economic activity in the State of South Carolina. Dr. Chen also played a leadership role in the HeteroFoaM Center, an Energy Frontier Research Center (EFRC) funded by the US Department of Energy. The EFRC is one of the only two such Energy Frontier Research Centers led by a university in the Southeast region and has help place South Carolina in the top five fuel cell states in the nation.

### **Caryn Outten University of South Carolina Columbia**

Dr. Outten received her Ph.D. in Chemistry from Northwestern University in 2000. Following a postdoctoral appointment at Johns Hopkins University she came to the University of South Carolina in 2005 where she currently is Associate Professor of Chemistry.

Dr. Outten is an emerging international leader in the fields of metal ion homeostasis and redox biology. Her research has been published and highlighted in a number of high impact journals and has been cited over 180 times by colleagues around the world. She has been invited to give over 30 seminars at academic institutions and international conferences in the United States, Asia, Europe, and South America and recently was selected to chair two international bioinorganic chemistry conferences scheduled for later in 2013 and in 2014. Dr. Outten has received several prestigious awards including the 2005 Transition to Independent Positions Award from the National Institute of Environmental Health Science and the prestigious 2009 Presidential Early Career Award for Scientists and Engineers. In 2011 she was recognized by the University of South Carolina as a Breakthrough Rising Star.

## **Governor's Award for Excellence in Scientific Research at a Predominately Undergraduate Institution**

is awarded to

### **Gilles Einstein Furman University**

Dr. Einstein received his Ph.D. in psychology from the University of Colorado in 1977. That same year he joined the faculty at Furman University where he currently is William R. Kenan, Jr. Professor of Psychology.

Dr. Einstein is best known for his research on fundamental questions of human memory. He has published 6 books, 28 book chapters, and 70 journal articles. His research is published in the very best journals, including the Journal of Experimental Psychology and Memory, and has a high citation rate. His research has been funded by major granting agencies including the National Science Foundation, National Aeronautics and Space Administration, National Institutes of Health (including four RO1 awards), and the National Institute on Nursing Research. He also has served on the Editorial Boards of several major journals including Psychology and Aging and Experimental Psychology. Dr. Einstein has actively involved undergraduates students in his research, including 34 undergraduates as coauthors on his publications and more than 170 as coauthors on presentations made at national, regional, or state meetings. Dr. Einstein is a Fellow of the American Psychological Association, the Association for Psychological Science, and the Council on Undergraduate Research. He received Furman University's Meritorious Teaching Award in 1985 and the South Carolina Independent Colleges and Universities Association Excellence in Teaching Award in 2006.



## **DWIGHT CAMPER UNDERGRADUATE AWARD IN PLANT MEDICINE OR NATURAL PRODUCTS RESEARCH**

Dwight Camper was an icon at Clemson University, having taught thousands of students and mentoring more than 50 graduate students during his 43 year tenure as professor in the Department of Plant Pathology and Physiology.

In addition to his teaching and mentorship, Dr. Camper was an active member of the South Carolina Academy of Science, serving as president for two terms. He received many awards through his career including the Cutting Edge endowment professorship by the SC Commission of Higher Education, the Godley Snell Award for Excellence in Agricultural Research, and Clemson University Marshall.

The Dwight Camper Research Award is given to an undergraduate student engaged in research in the Plant Sciences with first preference given to students in the field of Plant Medicine or Natural Products Research. Dr. Camper taught a very popular class at Clemson University called Plant Medicine, Magic and Murder. This was the first exposure most students had to Plant Medicine and led many to pursue research in his laboratory. These students benefited from his rigorous guidance while learning to use the scientific method to arrive at meaningful conclusions. Dr. Camper appreciated students who demonstrated a passion for the botanical sciences and approached research with an inquisitive mind, creativity and perseverance. His encouragement and can-do attitude enabled his students to become successful researchers. Dr. Camper felt deeply that research findings should be enthusiastically shared with others and encouraged his students to participate in the South Carolina Academy of Sciences as an avenue to share their discoveries.

This award is presented at the Annual Meeting of the South Carolina Academy of Science to an undergraduate student with an overall GPA of 3.0 or better who engages in research in plant medicine and natural product discovery for at least 1 year, and who has contributed to the generation of a scientific publication(s). This award is sponsored by Jane Camper

**The 2013 DWIGHT CAMPER UNDERGRADUATE AWARD  
IN PLANT MEDICINE OR NATURAL PRODUCTS RESEARCH**

is awarded to

**The research team of  
Ms. Kimberly Klas, Mr. Brett Hoover, and  
Ms. Brenna Norton-Baker  
of the Department of Chemistry, College of Charleston**

Their strong contributions and continuing progress on the project: Design, Synthesis, and Assessment of Chemotherapeutic Phthalazinones (Based on a Novel 2D-QSAR Model) on Prostate Cancer resulted in four presentations - two at the local level, two at the regional level, and two that have been submitted at the state level to SCAS. In addition, they were major contributors to a NIH-AREA grant submission.

Their research was performed under the direction of their faculty advisor, Dr. Justin Wyatt of the College of Charleston, in collaboration with Dr. Yuri Peterson and Craig Beeson of the Medical University of South Carolina.

**TOPICAL SESSIONS SCAS**  
**Saturday, April 13th**

**CHEMISTRY AND BIOCHEMISTRY**  
**BENJAMIN E. MAYS HUMAN RESOURCES CENTER ROOM 131**  
**SESSION MODERATOR: DR.LI CAI, USC SALKEHATCHIE**  
**9:45AM-12:15 PM**

- 9:45 PREPARATION OF CURCUMINS FROM ACETYLACETONE TRIANIONS SELECT ESTERS INCLUDING COUMARINS, AND SELECT KETONES OR ALDEHYDES  
**William G. Shuler**, Alton R. Thomas, Clyde R. Metz, and Charles F. Beam, *College of Charleston*
- 10:00 PREPARATION OF PYRAZOLE-BENZENESULFONAMIDES FROM THE CONDENSATION -CYCLIZATION OF DILITHIATED PHENYLHYDRAZONES WITH LITHIATED METHYL 2-AMINOSULFONYL-BENZOATE OR 4-AMINOSULFONYLBENZOATE AND OTHER BENZENESULFONAMIDE ESTERS  
**Steven A. Luther**, Jennifer L. Radke, William G. Shuler, Alton Ray Thomas, Marco Gattoni-Celli, and Charles F. Beam. *College of Charleston*
- 10:15 PREPARATION OF CURCUMIN AZOLES FROM TRILITHIATED HYDROXYACETOPHENONE OXIMES OR TRILITHIATED HYDROXYACETOPHENONE HYDRAZONES AND VARIED ESTERS INCLUDING COUMARINS  
**Marco Gattoni-Celli**, William G. Shuler, Alton Ray Thomas, and Charles F. Beam. *College of Charleston*
- 10:30 PREPARATION OF CURCUMIN AZOLES BY THE CONDENSATION-CYCLIZATION OF DILITHIATED HYDRAZONES OR DILITHIATED OXIMES WITH SELECT COUMARINS  
**Jennifer L. Radke**, Steven A. Luther, William G. Shuler, Alton Ray Thomas, and Charles F. Beam. *College of Charleston*
- 10:45 SYNTHESIS AND BIOLOGICAL EVALUATION OF NOVEL CHEMOTHERAPEUTIC PHTHALAZINONE ANALOGS ON PROSTATE CANCER  
**Brett Hoover**, Kimberly Klas, Brenna Norton-Baker, and Justin Wyatt. *College of Charleston*
- 11:00 **BREAK**
- 11:15 SOLVENT-DRIVEN ASSEMBLY OF POLY(3-HEXYLTHIOPHENE) AGGREGATES  
Calynn E. Johnson, and **David S. Boucher**. *College of Charleston*
- 11:30 PRODUCTION AND CHARACTERIZATION OF FLEXIBLE AND RIGID POLYURETHANE FOAMS USING BIO-BASED SURFACTANTS  
**Brett S. Snyder**, and Neal E. Tonks. *College of Charleston*
- 11:45 PURIFICATION OF QUANTUM DOTS BY GEL PERMEATION CHROMATOGRAPHY  
**Yi Shen**, Megan Y. Gee, Rui Tan, Perry J. Pellechia, and Andrew B. Greytak. *University of South Carolina, Columbia*

- 12:00 STUDY OF SHELL GROWTH MECHANISM FOR CDSE/CDS CORE/SHELL QUANTUM DOTS BY SILAR METHOD  
**Rui Tan**, Douglas A. Blom, Shuguo Ma, and Andrew B. Greytak. *University of South Carolina, Columbia*

**BIOLOGY AND ENVIRONMENTAL SCIENCES**  
**BENJAMIN E. MAYS HUMAN RESOURCES CENTER ROOM 132**  
**SESSION MODERATOR: DR. ERAN KILPATRICK, USC SALKEHATCHIE**  
**9:45AM-1:00 PM**

- 9:45 ENVIRONMENTAL SCIENCE EDUCATION AT ALLEN UNIVERSITY  
**Tomohiro Kawaguchi**. *Allen University*
- 10:00 ECOTOXICOLOGICAL ASSESSMENT OF GILLS CREEK WATER QUALITY  
**Amber Lloyd**. *Allen University*
- 10:15 THE VASCULAR FLORA OF BROOKHAVEN NATIONAL LABORATORY, LONG ISLAND, NEW YORK  
**Richard Stalter**, E. E. Lamont, Y. Bashir, V. Henriques, T. Keitt, N. Lamare, C. Nwajei, A. Nafaset, S. Rabb, N. Rencher, S. Shehzadi, R. Yousef, W. Ara, J. Reed, and A. Przemielewska. *St. John's University*
- 10:30 EVIDENCE OF GENETIC VARIATION AND ADAPTIVE PHENOTYPIC PLASTICITY IN TWO INVASIVE ANNUAL GRASSES IN CALIFORNIA  
**Shana Woodward** and Andy Dyer. *USC Aiken*
- 10:45 FACTORS INFLUENCING THE GERMINATION OF DIMORPHIC SEEDS IN AEGILOPS TRIUNCIALIS  
**Ricardo Garza** and Andy Dyer. *USC Aiken*
- 11:00 THE PRESENCE OF GLYPHOSATE-RESISTANT WEED SEEDS IN COMMERCIAL POTTING SOILS  
**Katherine I. Layne** and Andy Dyer. *USC Aiken*
- 11:15 BREAK
- 11:30 ABILITY OF THE REMNANT PATHWAY LEFT BY THE SHOOT OF THE LARGE SEED OF AEGILOPS TRIUNCIALIS TO FACILITATE EMERGENCE OF THE SMALLER SIBLING SEED  
**Jesse Baxley** and Andy Dyer. *USC Aiken*
- 11:45 EXPLORING THE MECHANISMS OF ALLELOPATHIC INTERACTIONS IN THE INVASIVE ANNUAL PLANT, PHYLLANTHUS URINARIA  
**Alyssa Smith** and Andy Dyer. *USC Aiken*
- 12:00 ELEMENTAL ANALYSIS AND BIOINDICATORS IN ASSESSMENT OF WATER QUALITY IN THE POCOTALIGO WATERSHED IN SUMTER, SC  
**Rachel Byrd**, Alexander Sims, Christopher Brandon, Erika Balogh, Kajal Ghoshroy, and Pearl Fernandes. *USC Sumter*
- 12:15 BIOMASS FEEDSTOCK IN THE UNITED STATES  
**Cory Wright** and Mark Downing. *Morris College and Oak Ridge National Park*

12:30 IDENTIFYING IN-STREAM FLOW REQUIREMENTS & ECOLOGICAL DRIVERS FOR HYDROPOWER PROJECTS IN THE ACF (APALACHICOLA, CHATTAHOOCHEE, FLINT) RIVER BASIN

**Evan Robinson** and Brennan Smith. *Morris College and Oak Ridge National Park*

12:45 THE ANALYSIS OF AN EPIGENETIC MODIFICATION IN AMERICAN ALLIGATORS ORIGINATING FROM CONTAMINATED AND REFERENCE ENVIRONMENTS

**Aposia Singleton** and Ben Parott. *Morris College and Oak Ridge National Park*

### MOLECULAR BIOLOGY

BENJAMIN E. MAYS HUMAN RESOURCES CENTER ROOM 133

SESSION MODERATOR: DR. MIN-KEN LIAO, FURMAN UNIVERSITY

9:45AM-1:00 PM

9:45 ANTIPROLIFERATIVE ACTIVITY OF RASPBERRIES ON TWO HUMAN BREAST CANCER CELL LINES

**Georgia M. Harpe**, Donna R. Weinbrenner, and Diana S. Ivankovic. *Anderson University*

10:00 THE ROLE OF GALECTIN-3 IN MACROPHAGE-LEYDIG CELL INTERACTIONS

**Jazra Gibson-Jackson**, Bill McAmis, and Samir Raychoudhury. *Benedict College*

10:15 EFFECTS OF TAMOXIFEN, BENZO-A-PYRENE, AND POLYCYCLIC AROMATIC HYDROCARBONS ON GALECTIN-3 EXPRESSION IN HUMAN BREAST CANCER CELLS

**Feven Mulu**, Bill McAmis, and Samir Raychoudhury. *Benedict College*

10:30 EFFECTS OF INHIBITION OF PROTEASOME AND MITOGEN ACTIVATED KINASE (MAPK) PATHWAYS ON CELL VIABILITY IN BREAST CANCER

**Alexander J. Hamilton** and Rush H. Oliver. *Benedict College*

10:45 EFFECT ON CELL VIABILITY OF PROSTATE CANCER CELLS FOLLOWING CERAMIDE/CHLOROQUINE COMBINATION TREATMENT

**Christopher Johnson**, Lorianne Stehouwer Turner, Krissy Smith, Lenton Holley, Timothy Prince, and Heather Yancey. *Francis Marion University*

11:00 BREAK

11:15 INHIBITION OF INSULIN-LIKE GROWTH FACTOR SIGNALING IN A SMALL CELL LUNG CANCER CELL LINE

**Tyana McNeill** and Saku Warshamana-Greene. *SC State University*

11:30 BIOLOGICAL IMPLICATIONS OF DNA GLYCATION IN PROSTATE CANCER DISPARITIES

**Danzell Smith**, John Hepburn, and Mahtabbuddin Ahmed. *SC State University*

11:45 ANTI-HIV VIF ACTIVITY USING A HAMMERHEAD RIBOZYME EXPRESSED FROM AN RNA POLYMERASE III PROMOTER

**Madison T. Sweet**, Alexander S. Jureka, and William H. Jackson. *USC Aiken*



- 12:00 QUANTITATIVE ANALYSIS OF GENE EXPRESSION FROM A GENE CASSETTE CONTROLLED BY THE HIV-1 PROMOTER/ENHANCER  
**Emily R. Bush** and William H. Jackson. *USC Aiken*
- 12:15 USING MICROBIAL SOURCE TRACKING TECHNIQUES TO IDENTIFY FECAL INDICATOR BACTERIA IN THE HORSE CREEK WATERSHED IN AIKEN, S.C.  
**Kaitlyn Edgington**, S. Michele Harmon, and Pamela W. Steen *University of South Carolina-Aiken*
- 12:30 IDENTIFICATION OF SUBCELLULAR MOLECULAR TARGETS OF THE ALGAL BIOTOXIN, AZASPIRACID  
**Rhonda Hook**, Greg Doucette, and Jinkeng Asong. *Morris College and Medical USC*
- 12:45 THE DEVELOPMENT OF PROGNOSTIC MARKERS IN PANCREATIC CANCER  
**Tiesha James** and Urga Singh. *Morris College and University of South Carolina, Columbia*

**MEDICINE, PHARMACY & PUBLIC HEALTH  
BENJAMIN E. MAYS HUMAN RESOURCES CENTER ROOM 134  
SESSION MODERATOR: DR. STEFANIE BAKER, WOFFORD COLLEGE  
9:45AM-11:15 AM**

- 9:45 TEMPERATURE VARIATIONS WITHIN AND BETWEEN INCUBATORS  
**Meredith W. Walker**, Julia M. Butler, H. Lee Higdon III, and William R. Boone. *Greenville Hospital System University Medical Center*
- 10:00 THE HUNT FOR A METHOD TO PREDICT PREGNANCY OUTCOME BASED ON SPERMATOZOAL PARAMETERS – A CONTINUING SAGA  
**Lindsay T. Motes**, H Qiao, H. Lee Higdon III, WC Bridges, Jr., JD Shoultz and William R. Boone. *Greenville Hospital System University Medical Center*
- 10:15 EMBRYO TRANSFER (ET) FACTORS AFFECTING CLINICAL PREGNANCY RATES: A UNIVARIATE ANALYSIS  
**Lindsay E. Eller**, David A. Forstein, H. Lee Higdon, and William R. Boone. *Greenville Hospital System University Medical Center*
- 10:30 THE USE OF ACCUBEADS AS A QUALITY CONTROL MEASURE FOR THE COMPUTER AUTOMATED SEMEN ANALYZER  
**Darian D. Vernon**, Jane E. Johnson, Angela M. Houwing, H. Lee Higdon III and William R. Boone. *Greenville Hospital System University Medical Center*
- 10:45 STIS: ARE THE YOUTH OF TOMORROW PREPARED FOR THE INFECTIONS OF TODAY?  
**Taylor Ford**, Amy O'Brath, Christopher Antwine, and Pearl Fernandes. *USC Sumter*
- 11:00 FAST FOOD VERSUS SLOW FOOD: WHAT STUDENTS EAT WHEN THEY HAVE NO TIME  
**Randi Page**, Trevor Herring, and Pearl Fernandes. *USC Sumter*

**PHYSICS AND ASTRONOMY**  
**BC CARES ROOM POA**  
**SESSION MODERATOR: DR. VIRGINIA PROBIN, CHARLESTON SOUTHERN**  
**UNIVERSITY**  
**9:45 AM-11:30 AM**

- 9:45 THE SUBARU SEEDS IMAGING SEARCH FOR EXOPLANETS AROUND HIGH-MASS STARS  
**Thea Kozakis**. *College of Charleston*
- 10:00 COMPUTATIONAL INVESTIGATION OF GAMMA SYNCHRONIZATION USING OPTOGENETIC MODULATION OF PREFRONT CORTEX  
**Patrick Lynn**, Sorinel A. Oprisan, Antonieta Lavin, and Tamas Tompa. *College of Charleston*
- 10:15 AEROSOL MIXING  
**Michael Chute**. *College of Charleston*
- 10:30 HOW TO RESET THE PHASE OF A NEURON  
**Davy Vanderweyen**, Derek Tuck, and Sorinel A. Oprisan. *College of Charleston*
- 10:45 CONCENTRATION FLUCTUATIONS IN NANOCOLLOIDAL SUSPENSIONS  
**Alexis Payne**, and Ana Oprisan. *College of Charleston*
- 11:00 ATMOSPHERIC GRAVITY WAVES  
**Brian Rogers**. *Coastal Carolina University*
- 11:15 PHYSICS LABS WITH FLAVOR  
**Mikhail M. Agrest**. *Trident Technical College*

**MATHEMATICS AND COMPUTER SCIENCE**  
**BC CARES ROOM POB**  
**SESSION MODERATOR: DR. JUSTIN WYATT, COLLEGE OF CHARLESTON**  
**9:45 AM-1:15 PM**

- 9:45 HEATING AND COOLING OF A BUILDING  
**Walter Cureton**, and Naima Naheed. *Benedict College*
- 10:00 SATISFACTORY HIGHWAY CRUISING SPEED OF A VEHICLE  
**Betsey Dorvilus**, Kelvonte Bates, **Nailong Guo**, Naima Naheed and Woon-Kwan Lam. *Benedict College*
- 10:15 QUEUE LENGTH ESTIMATION FROM PROBE VEHICLES AT SIGNALIZED INTERSECTIONS  
**Yeadon, Kenneth**, Gurcan Comert, Gary Knight, Tatyanna Taylor, April Chappell, Tia Herring, Biegon Winnifer, and Hohite Fetene. *Benedict College*
- 10:30 ONTOLOGY GRAPH BASED QUERY EXPANSION FOR BIOMEDICAL INFORMATION RETRIEVAL  
**Yuanyuan Zhang**, and James Wang. *Clemson University*

- 10:45 SELF-STABILIZING MASTER-SLAVE TOKEN CIRCULATION ALGORITHM IN AN UNDIRECTED RING OF ARBITRARY SIZE AND ITS ORIENTATION  
**Yihua Ding**, *Clemson University*
- 11:00 BREAK
- 11:15 AN AGGREGATE INFORMATION CONTENT BASED METHOD TO MEASURE THE SEMANTIC SIMILARITY OF GO TERMS  
**Xuebo Song**, *Clemson University*
- 11:30 ONLINE SERVICE FOR CONVERTING COMMAND LINE PROGRAMS INTO WEB SERVICE  
**Jiao Li**, *Clemson University*
- 11:45 CYBER-PHYSICAL ARCHITECTURE, CLOUD COMPUTING AND MOBILITY: THE VERTICAL DESIGN OF A SENSOR-BASED, MICROCONTROLLER SYSTEM  
William Southgate, **William Binnicker**, and Chris Starr. *College of Charleston*
- 12:00 THE HUBBLE EXOPLANET CLASSROOM  
**Laura Stevens**, *College of Charleston*
- 12:15 DEBLURRING IMAGES USING SINGULAR VALUE DECOMPOSITION  
**Wei-Fang Liu**, *The Citadel*
- 12:30 HOW WELL DO SCIENCE FRESHMAN UNDERSTAND SOURCE CITATION?  
**Brittany Cheeks** and Michelle Vieyra. *USC Aiken*
- 12:45 PROOF (ALMOST) WITHOUT WORDS: CONIC SECTIONS  
**Philip Kearse**, *USC Salkehatchie*
- 1:00 CULTURAL INFORMATICS: AN IMAGE-BASED EXPLORATION  
**Lewis Fordjour**, and Rangan Sukumar, *Morris College*

### SCAS Undergraduate Presentation Judges 2013

Fernanda Burk, USC Lancaster  
Li Cai, USC Salkehatchie  
Michelle Durant, SC State University  
Neval Erturk, Converse College  
David Ferris, USC Upstate  
Terry Fetemie, USC Union  
Bettie Obe Johnson, USC Lancaster  
Don Jordan, USC Columbia  
Eran Kilpatrick, USC Salkehatchie  
Wei-Kai Lai, USC Salkehatchie  
Min-Ken Liao, Furman University  
Helene Maire, USC Union  
Fidele Ngwane, USC Salkehatchie  
Lucia Pirisi-Creek, USC School of Medicine  
Ron Ruszczyk, USC Aiken  
Walteena Simpson, SC State University

**POSTER SESSION  
BC CARES ARENA  
9:45 AM-1:30 PM**

**(Presenters must be at their posters from 10:00 am to 12:00 pm)**

**CHEMISTRY AND BIOCHEMISTRY**

- 1) ELUCIDATION OF A NOVEL ALTERNATIVE RNA SPLICING MECHANISM IN MAMMALIAN CELLS  
**Natalie Dixon**, Kristen Polivka, and Rachael Whitaker. *Coastal Carolina University*
- 2) THE EFFECTS OF SALINITY, PH, TEMPERATURE AND DISSOLVED OXYGEN ON THE SENSITIVITY OF PCR IDENTIFICATION OF T4 IN ESTUARINE WATER  
**Joseph Cannon**, Nicholas Thurn, and Paul Richardson. *Coastal Carolina University*
- 3) TRANSLOCATION MUTANTS IN LEUCYL-TRNA SYNTHETASE RESULT IN INTRACELLULAR TOXICITY FOR E. COLI  
**Daniel McDonough** and Rachel Whitaker. *Coastal Carolina University*
- 4) IN-VITRO STUDIES OF NEWLY SYNTHESIZED PHTHALAZINONE CHEMOTHERAPEUTICS  
**Kimberly Klas**, Brett Hoover, Brenna Norton-Baker, and Justin Wyatt. *College of Charleston*
- 5) DESIGN AND SYNTHESIS OF DUAL ACTIVE DERIVATIVES OF NOVEL ANTIBIOTIC CYTOSPORONE E  
**Brenna C. Norton-Baker** and Justin K. Wyatt. *College of Charleston*
- 6) SOLVENT-FREE PERACETYLATION OF CARBOHYDRATES  
**Chris Rufty** and Li Cai. *USC Columbia*

**BIOLOGY AND ENVIRONMENTAL SCIENCES**

- 7) APPLICATION OF OLYMPUS BIO IMAGING NAVIGATOR FSX100 ON ENVIRONMENTAL SCIENCE RESEARCH AT ALLEN UNIVERSITY  
**Shuntavia Coleman**. *Allen University*
- 8) APPLICATION OF BIORAD'S GMO INVESTIGATOR KIT TO TEST FOR THE PRESENCE OF GENETICALLY MODIFIED ORGANISMS (GMOS) IN FOODS PURCHASED FROM PUBLIX AND EARTH FARE  
**Keshaun C. Chisolm**. *Allen University*
- 9) THE EFFECTIVENESS OF THE HDE® SONIC MOSQUITO INSECT REPELLER KEYCHAIN IN REPELLING DIFFERENT GENERA OF MOSQUITOS IN SOUTH CAROLINA  
**Andrea Coker**, Emily Harris. *Columbia College*
- 10) CHANGES IN COMMUNITY STRUCTURE OF TWO INVASIVE BIVALVES IN LAKE ERIE  
**Thomas Walker**, Ann Stoeckmann, and Jeff Steinmetz. *Francis Marion University*

- 11) IDENTIFYING FECAL POLLUTION SOURCES THROUGH ANTIBIOTIC RESISTANCE ANALYSIS (ARA) IN SAND RIVER IN AIKEN COUNTY, SC  
**Asheeba Baksh**, J.R. Yates, and S.M. Harmon. *USC Aiken*
- 12) POPULATION DYNAMICS OF THE INVASIVE D. LUMHOLTZI IN LAKE WATEREE, SC  
**Daniel Truncellito**, Jeff Steinmetz, Ann Stoeckmann, John Ludlam, and Derek Turner  
*Francis Marion University*

### MOLECULAR BIOLOGY

- 13) THE ROLE OF GBA EXPRESSION IN CERAMIDE INCREASE SEEN IN SENESCENCE  
**Virginia B. Probin**, Ashton Shultz, and Joshua Muccitelli. *Charleston Southern University*
- 14) GENETIC MAPPING OF A NOVEL MICRORNA TRANSLATIONAL REGULATION MUTANT IN PLANTS  
**Michele Howard** and Charlotte Song. *Charleston Southern University*
- 15) MEASUREMENT OF ANTI-MULLERIAN HORMONE AND INHIBIN B AS FERTILITY INDICATORS IN SANDDOLLARS AND DEER  
**Cayla Gilroy**, Caleb Kirkpatrick, and William Roudebush. *Charleston Southern University*
- 16) SEARCHING FOR PROPHYLACTIC BACTERIOPHAGES THAT INFECT AND LYSE STAPHYLOCOCCUS AUREUS OR ESCHERCHIA COLI.  
**Ina Troutman**, Jordan Wesel, and Paul E. Richardson. *Coastal Carolina University*
- 17) ACTH AFFECTS ACID CERAMIDASE EXPRESSION IN ADRENAL CORTEX CELLS  
**Heather Yancey**, Lorianne Stehouwer Turner, Teresa Herzog, Krissy Smith, Lenton Holley, Christopher Johnson, and Timothy Prince. *Francis Marion University*
- 18) COLLOIDAL QUANTUM DOT SENSORS FOR THE DETECTION OF UNUSUAL DNA STRUCTURES ASSOCIATED WITH HUMAN DISEASES  
**Faheem, H. Muhammed**; Adisa, M. M. Julien; Arielle, S. Orridge; April Pearson-Wright, and Rahina Mahtab. *SC State University*
- 19) FIBROBLAST CELL GROWTH INHIBITION BY INSULIN-LIKE GROWTH FACTOR RECEPTOR INHIBITOR  
**Jelisa Gordon**, and Saku Warshamana-Greene. *SC State University*
- 20) COMPARATIVE STUDY OF HIV-1 INDUCED APOPTOSIS BY EXPRESSION OF PRO-APOPTOTIC BAX AND TBID  
**Priscilla S. Simon**, Claudia A. Fulmer, and William H. Jackson. *USC Aiken*
- 21) CLONING AND TESTING A DNA-TRANSPOSON BASED GENE DELIVERY SYSTEM  
**DeAnndra C. Pickens**, Emily M. Webb, and William H. Jackson. *USC Aiken*

*Continued on Next Page*

## MEDICINE, PHARMACY & PUBLIC HEALTH

- 22) D-AMINO ACID INHIBITORY PROPERTIES ON BACTERIAL GROWTH  
**Kayla Liland**, McKynsey Douglas, and Paul E. Richardson. *Coastal Carolina University*
- 23) DOSE DEPENDENT EFFECTS OF CAFFEINE ON COGNITIVE PERFORMANCE AND NEURONAL ACTIVATION  
**Stephan Albrecht**, Helen Morris, and Michelle Vieyra. *USC Aiken*
- 24) INHIBITION OF THE MTOR/PI3K PATHWAY TO ENHANCE SENSITIVITY OF OVARIAN CANCER CELLS TO CHEMOTHERAPY TREATMENT  
**Lindy Pence**, Zachary Dobbin, Adam Steg, Ashwini Katre, and Charles Landen. *Wofford College*

## MATHEMATICS AND COMPUTER SCIENCE

- 25) DEID – A TOOL FOR DE-IDENTIFYING NEUROIMAGING DATASETS  
**Wang A**, Wang Z, Prescott C, Morris L, Li L, and Eckert MA. *Clemson University*
- 26) OBSIDIAN: PATTERN-BASED UNIT TEST IMPLEMENTATIONS  
**Hunter Hegler**. *College of Charleston*
- 27) A MISERE NIM GAME  
**Ibrahima Seck**, and Robbie Bacon. *USC Salkehatchie*

## SCAS ABSTRACTS

### PHYSICS LABS WITH FLAVOR

Mikhail M. Agrest

Physical Sciences Department, Trident Technical College

Exposing students to scientific activities is the essential part of education at all stages independently of students' career goals and the objectives of the school. Introductory Physics course with labs might vary from a High school, 2 year Community College, 4 year College, or University. The main goal of teaching a Science course, Physics in particular, is not just to expose students to basic concepts of nature. It is also to teach the Scientific Method, relationship among events, cause-effect relationships. Presented work is dedicated to the method [1,2] of teaching Introductory Physics labs that makes students' activities be similar to the work of a researcher. The teaching method is expanded to other disciplines.

### DOSE DEPENDENT EFFECTS OF CAFFEINE ON COGNITIVE PERFORMANCE AND NEURONAL ACTIVATION

Stephan Albrecht, Helen Morris and Michelle Vieyra

Department of Biology and Geology, USC Aiken

Many students assume that the more caffeine you drink, the better your cognitive performance. Overconsumption of caffeine has many negative effects so if there are no dose related cognitive benefits to large amounts of caffeine then college students should limit their intake. This study looked at whether ingesting a medium dose (200mg) versus a lower dose (100mg) of caffeine improved short term memory, measured with an n-back test, as compared to a control group. In addition, we looked at whether larger doses of caffeine produced a difference in neuronal activation during these tests as measured by functional near-infrared spectroscopy (fNIR). Even if performance on cognitive tests is the same, greater or lesser increases in neuronal activation during the test may be associated with increased or decreased brain efficiency. For example, a smaller increase in neuronal activation has been associated with improved brain efficiency (less energy is needed to perform the same task) while a greater increase has been associated with over-arousal and inefficiency. Initial results suggest that neuronal activation increases as the difficulty of the cognitive task increases. Because this is a double-blind study comparisons between subject groups cannot be made until the study is concluded.

### IDENTIFYING FECAL POLLUTION SOURCES THROUGH ANTIBIOTIC RESISTANCE ANALYSIS (ARA) IN SAND RIVER IN AIKEN COUNTY, SC

Asheeba Baksh, J.R. Yates, and S.M. Harmon

Department of Biology and Geology, USC Aiken

Antibiotic Resistance Analysis (ARA) was used to identify sources of fecal pollution in Sand River, which is a part of the Horse Creek Watershed in Aiken County, South Carolina. Sand River is has long been associated with fecal coliform pollution within the Horse Creek watershed. Horse Creek drains into Langley Pond, and the presence of these bacteria indicate a potential health hazard for the population who engage in recreational activities in the pond. The objectives of the project were to determine if the majority of fecal coliforms found in Sand River were from untreated sewage, and if rainfall increased the amount of fecal coliform present in the water from untreated sewage. Fecal coliforms were isolated from two locations in Sand River and tested for their resistance to six common antibiotics (Streptomycin, Tetracycline, Kanamycin, Apramycin, Trimethoprim, and Rifampicin). These patterns of antibiotic resistance were then compared to resistance patterns from known sources (dogs, horses, waterfowl, and sewage). Using a discriminant function analysis, the results indicated that coliform bacteria matching the library profiles for both horse and sewage were present in approximately equal amounts. There was, however, an increase of fecal coliform which matched the profile of untreated sewage in the river after periods of rainfall.

### ABILITY OF THE REMNANT PATHWAY LEFT BY THE SHOOT OF THE LARGE SEED OF *AEGILOPS TRIUNCIALIS* TO FACILITATE EMERGENCE OF THE SMALLER SIBLING SEED.

Jesse Baxley and Andy Dyer

Department of Biology and Geology, USC Aiken

Many invasive species exhibit reproduction strategies that appear to facilitate their success in invaded habitats. These strategies are often associated with seed traits and may involve size and mass, production, dormancy, and germination timing and cueing. *Aegilops triuncialis* (barbed goatgrass) is an invasive annual grass of northern California that is spreading rapidly and is capable of invading very harsh soils and stressful habitats. It is unusual because it produces spikelets with pairs of dimorphic seeds that are genetically identical but which have differing germination patterns where the smaller seed typically shows delayed germination. The mechanism governing the differential germination patterns in identical seeds is unknown, but such an adaptation should convey a fitness advantage. While a seed bank represents a sort of "insurance policy" for the maternal plant, we suggest that an adaptation for delayed germination only makes adaptive sense if the large seed facilitates the success of the small seed. We tested this prediction by sowing spikelets with both seeds and with the large seed removed to determine whether the emergence of the small seed was more likely after the large seed had already emerged. Spikelets were sown at a range of depths from 3-12 cm. We predicted that small seeds were less likely to survive if they did not

germinate next to the remains of the sibling plant that could act as a pathway for the emergence of the shoot from the small seed.

#### PREPARATION OF CURCUMIN AZOLES BY THE CONDENSATION-CYCLIZATION OF DILITHIATED HYDRAZONES OR DILITHIATED OXIMES WITH SELECT COUMARINS

Jennifer L. Radke, Steven A. Luther, William G. Shuler, Alton Ray Thomas, and Charles F. Beam  
Department of Chemistry and Biochemistry, College of Charleston

Dilithiated hydrazones or dilithiated oximes undergo condensation-cyclization with select coumarins. Easily prepared hydrazones, or oximes made by the condensation of ketones, such as substituted acetophenones, with substituted hydrazines, such as phenylhydrazine, or with hydroxylamine were dilithiated with excess lithium diisopropylamide (LDA) followed by condensation with coumarin or substituted coumarins to afford *C*-acylated intermediates that were not usually isolated. They were immediately cyclized with dilute hydrochloric acid to afford 2-hydroxy-phenylethenylpyrazoles or 2-hydroxy-phenylethenylisoxazoles (cinnamyl pyrazoles or cinnamyl isoxazoles). IR and NMR spectra indicated that the *cis* bonding-arrangement of the C3 and C4 protons (hydrogens) in the coumarin electrophile, due to rearrangement catalyzed by the acid, resulted in a product with a *trans* arrangement in the phenylethenyl moiety in the products. This *cis trans* rearrangement will be supported by molecular modeling and absolutely confirmed by single crystal X-ray crystallographic analysis. Also, all of the targeted curcumin pyrazoles and isoxazoles are candidates for informative biological evaluations, probably at the Medical University of South Carolina.

#### QUANTITATIVE ANALYSIS OF EXPRESSION FROM A GENE CASSETTE CONTROLLED BY THE HIV-1 PROMOTER/ENHANCER

Emily R. Bush and William H. Jackson  
Department of Biology and Geology, USC Aiken

A unique feature of HIV-1 transcription is the action of the viral Tat protein, which acts as a transcriptional regulator to increase transcription from the viral promoter. Tat binds to the TAR sequence, which is transcribed in the first 60 nucleotides of all HIV-1 mRNAs. This interaction recruits a number of host proteins which act to increase the processivity of RNA Polymerase II and thereby increase the efficiency of transcriptional elongation. We hypothesized that using the HIV-1 promoter/enhancer, termed U3R, would allow tat-dependent expression of therapeutic genes in HIV-1 infected cells. To test this hypothesis, we have designed an expression cassette that is controlled by the U3R region. These plasmids (pU3R) have been used to qualitatively show increased expression in the presence of tat. To measure the tat-dependent nature of gene expression, we have cloned the beta-galactosidase gene into a pU3R plasmid. The resulting plasmid, pU3R-betaGal was co-transfected into 293T cells with varying amounts of the tat-expression plasmid pCMV-Tat. The resulting tat-dependent activity of beta-galactosidase was analyzed using two assays, both of which are dependent on the ability of beta-galactosidase to cleave the chromogenic substrates: 5-bromo-4-chloro-indolyl- $\beta$ -D-galactopyranoside (X-gal) and o-nitrophenyl- $\beta$ -D-galactoside (ONPG). These studies have shown that beta-galactosidase activity is significantly increased in 293T cells that express HIV-1 tat.

#### ELEMENTAL ANALYSIS AND BIOINDICATORS IN ASSESSMENT OF WATER QUALITY IN THE POCOTALIGO WATERSHED IN SUMTER, SC

Rachel Byrd<sup>1</sup>, Alexander Sims<sup>1</sup>, Christopher Brandon<sup>2</sup>, Erika Balogh<sup>2</sup>, Kajal Ghoshroy<sup>1</sup>, and Pearl Fernandes<sup>1</sup>.

<sup>1</sup>Division of Science, Mathematics and Engineering, USC Sumter

<sup>2</sup> Electron Microscopy Center, USC Columbia

The Pocotaligo River originates in Sumter, South Carolina and encompasses over 30,000 acres of wetlands. This watershed has endured severe anthropogenic and natural alterations to its ecology over several decades. The Sumter Wastewater Treatment Plant (WWTP) discharges over 1 billion liters/month of effluent into the swamp and is a point source of pollution. The objectives of the present study were to determine the possible effects of non-point and point sources of pollution on water quality using physiochemical measurements, elemental analysis and biological indicators such as coliform bacteria and algae. Samples were taken multiple times a year from five sites on the Pocotaligo watershed. The site of the effluent discharge from the WWTP was considered to be the Point Source (PS). Two control sites upstream from the PS, namely Briar Branch Creek (6.27 stream km), relatively unimpacted by point and non-point sources of pollution and Turkey Creek (4.01 stream km), and impacted by non-point sources of pollution were chosen. The two downstream sites were at 0.3 (DS) and 6.27 (Twelve Bridges) stream km from the PS site.

Elemental analysis by Energy-dispersive X-ray spectroscopy revealed that potassium, calcium and chlorine were present at all five sites. However, aluminum was found at a much higher concentrations at Briar Branch, Turkey Creek and Twelve Bridges. Manganese and sulfur were found only at Briar Branch and Turkey Creek. Iron content was the highest at Turkey Creek. This site also contained fluorine, and molybdenum and the highest dissolved solids (104 mg/l) indicating possible contamination occurring at or just above Turkey Creek. Diatoms, flagellated unicellular and filamentous green algae were found in all sites but most abundant at Turkey Creek. Euglenoids were also mostly seen at Turkey Creek. Dissolved oxygen concentration was seen to rise between June and January, with the highest at Turkey Creek and lowest at Briar Branch where total dissolved solids were also substantially lower (31.8 mg/l). Abundant organic matter and the highest concentration of sodium were observed at PS. Coliforms were found at all sites with the PS and downstream sites having higher numbers than the upstream. Scanning electron microscopy indicated that the bacteria observed at the PS were mainly bacilli and cocci,



with a few spirilla. Cyanobacteria were restricted to the PS site and Twelve Bridges. It is thus likely that higher numbers of bacteria and organic matter being introduced at the effluent site leads to eutrophication, causing cyanobacteria to flourish at the PS and downstream sites.

#### THE EFFECTS OF SALINITY, PH, TEMPERATURE AND DISSOLVED OXYGEN ON THE SENSITIVITY OF PCR IDENTIFICATION OF THE T4 BACTERIOPHAGE IN ESTUARINE WATERS.

Joseph Cannon, Nicholas Thurn and Dr. Paul Richardson  
Dept. Of Biochemistry, Coastal Carolina University

Bacteriophages have been used as indicators to predict the presence of pathogenic bacteria in drinking, and waste waters. They have also shown potential in limiting aquatic bacterial populations through their lytic properties. While an excellent bacterial pollution indicator in drinking and waste water settings, little is known about the survival and persistence of bacteriophages in the harsher saline environments of seawater. The lower number of bacteriophage present in the saline environment requires a sensitive detection method to be an effective indicator of bacterial pollution. A Polymerase Chain Reaction (PCR) protocol has been developed by the research team, capable of identifying bacteriophage concentrations under ideal conditions. This technique targets two genes in the bacteriophage T4 genome, open reading frames 23 and 43, which code for the capsid protein and DNA polymerase, respectively. Both of these genes are highly conserved in the T4 bacteriophage. Tests in the laboratory have been as sensitive to detect five virus particles per testing volume, equating to about 230 viruses per milliliter of water sample collected. Water and soil samples were drawn from two tidal estuaries, their associated brackish water ponds and a multiple sites along of a coastal river. The effect of different water characteristics (salinity, pH, dissolved oxygen, and temperature) on the sensitivity of the PCR identification of virus particles were analyzed to determine at what levels bacteriophage can be detected in environmental samples with respect to each water property. The PCR technique utilized was capable of identifying the presence of the T4 bacteriophage across a wide range of salinity, pH, and dissolved oxygen and temperature conditions. Data obtained will allow for a bacteriophage detection threshold to be developed for environmental samples.

#### HOW WELL DO SCIENCE FRESHMAN UNDERSTAND SOURCE CITATION?

Brittany Cheeks<sup>1</sup> and Michelle Vieyra<sup>2</sup>

<sup>1</sup>College of Education, USC Aiken

<sup>2</sup>Department of Biology and Geology, USC Aiken

Students entering college may resort to acts of plagiarism for a variety of reasons including an overall lack of understanding and the pressure to complete work in their courses. Studies show that science, engineering and technology courses may have the highest occurrence of plagiarism, compared to other courses, because of the heavy workload, perceptions of laboratory reports as somehow different from other types of writing and difficulty with reading and writing in a new genre. First semester and senior science majors at USC Columbia and USC Aiken were asked to complete an online survey within the first two weeks of classes as part of their introductory biology lab. This survey consisted of demographic, scaled, and open-ended questions and a skill assessment to gauge the student's understanding of proper citation and paraphrasing techniques. Over 1000 students completed the survey. Preliminary data suggests that freshman do not have a full grasp of how to properly cite sources nor do they recognize instances of plagiarism or academic dishonesty as well as science students do in their senior year. It is likely that many of the instances of plagiarism observed in the freshman classroom are due to lack of understanding rather than intentional dishonesty. Time must be taken to properly instruct these students in source citation skills.

#### APPLICATION OF BIORAD'S GMO INVESTIGATOR KIT TO TEST FOR THE PRESENCE OF GENETICALLY MODIFIED ORGANISMS (GMOS) IN FOODS PURCHASED FROM PUBLIX AND EARTH FARE

Keshaun C. Chisolm

Department of Biology, Division of Mathematics & Natural Sciences, Allen University

Genetically modified organisms (GMOs) are animals, plants, and microbes whose genetic material has been altered using biotechnology. In 1980, Ananda Mohan Chakrabarty, a genetic engineer working for General Electric, engineered a bacterium from the *Pseudomonas* genus that was capable of breaking down crude oil, and suggested that it be used in the treatment of oil spills. Although scientists had been developing mechanisms for recombinant DNA since the late 1970s, it wasn't until Chakrabarty's development was brought before the U.S. Supreme court in 1980, that genetic engineering and its implications on the environment and human health gathered public interest and awareness. One area that has been greatly impacted by genetic engineering is agriculture. With the continuous growth of the world population and the depletion of farmable land, lead experts in the field of agriculture have been concerned with the world's ability to produce enough food to accommodate the growing population. Another area of great concern is the overuse of pesticides and herbicides, and the long term effects of these chemicals on the environment and human health. The biotechnology industry believed that genetically modified plants could solve both of these issues, and in 1996, the first genetically modified crop was released in the U.S. Despite the potential benefits, this "solution" has been greatly opposed throughout the world. In Europe GMOs are restricted, while in the U.S. not only are GMOs widely distributed and sold, but all foods containing these GMOs are not necessarily labeled as being genetically modified. Because of the ongoing GMO debate and the obvious implications on our health and the environment, I decided to carry out an experiment using BIORAD's Biotechnology Explorer GMO Investigator Kit to test foods bought from Earth Fare and Publix for the presence of GMOs.

In this study, four different food samples were tested:

- 1) Earth Fare's Ultimate Soy-Spirulina Protein Powder (advertised as non-GMO)
- 2) Publix Greenwise Instant Oatmeal (advertised as USDA certified organic)
- 3) Betty Crocker Super Moist Red Velvet Cake mix
- 4) Bisquick Original Pancake and Baking mix

The experimental design of this study involved: the extraction of DNA from each sample, the amplification of three different DNA sequences using Polymerase Chain reaction (PCR) and the electrophoresis of the PCR products on agarose gel (to visualize and identify the presence or absence of the amplified marker sequences). The GMO sequences that are being amplified by this kit are two of the most common regulatory sequences used to control the expression of genetically modified crops. The promoter sequence that is detected is the 35S promoter from the cauliflower mosaic virus and the terminator sequence that is detected is the nopaline synthase (NOS) terminator from *Agrobacterium tumefaciens*. The last sequence that is amplified is the control sequence. This sequence is the photosystem II (PSII) chloroplast gene that is common to most plants. Since this particular gene is common to most plants, all of our samples should have this sequence amplified. As of right now the results are pending, but will be included as soon as they have been confirmed and reproduced.

#### AEROSOL MIXING IN TURBULENT FLOW

Michael Chute

Department of Physics and Astronomy, College of Charleston

The diffusion and mixing of aerosol particles in turbulence is a common phenomenon in the atmosphere and indoor environments. We obtain characterizations of mixing properties in aerosol particles subjected to indoor turbulent flow. We expect results similar to the mathematics that govern diffusion, but hope to isolate the subtleties that would differ in a turbulent flow, from that of pure diffusion and brownian motion. We observe concentration fluctuations with optical particle counters modified to allow for temporal and spatial characterizations of mixing statistics. The interpretation of the data could identify an appropriate paradigm for characterizing indoor aerosol particle mixing on assorted temporal and spatial scales

#### THE EFFECTIVENESS OF THE HDE® SONIC MOSQUITO INSECT REPELLER KEYCHAIN IN REPELLING DIFFERENT GENERA OF MOSQUITOS IN SOUTH CAROLINA

Andrea Coker, Emily Harris, Lou Rigley, and Marlee B. Marsh  
School of Business, Mathematics and Science, Columbia College

Mosquito populations are prominent in South Carolina and certain genera are established carriers of diseases that affect both humans and animals such as West Nile Virus and Eastern Equine Encephalitis (EEE). Thus, mosquito control, particularly of certain genera, is of great interest. Two mosquito traps were set up in the summer of 2012 at Saluda Sholes Park for 24 hours. In addition to the standard trap, one trap had a HDE® Sonic Mosquito Insect Repeller Keychain repellent attached in order to determine its effectiveness. One hundred and sixty-two mosquitoes were collected from both traps and identified to genus (*Anopheles*, *Aedes*, *Culiseta*, *Psorophora*, and *Uranotaenia*). While there were no significant differences in the total number of mosquitoes between the control and experimental trap, the number of *Culiseta* species, a vector of EEE, was significantly different between trap types.

#### APPLICATION OF OLYMPUS BIO IMAGING NAVIGATOR FSX100 ON ENVIRONMENTAL SCIENCE RESEARCH AT ALLEN UNIVERSITY

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Allen University Department of Biology is the first academic institution in the southeastern US to acquire the new generation microscope, Olympus FSX100 Bio Imaging Navigator, to improve Environmental Science Research. The new FSX100 Bio Imaging Navigator removes complicated microscope adjustments and sets up procedures so that the efficiency of research activities is dramatically improved. FSX100 Bio Imaging Navigator has three established microscopy modes (Fluorescence, Phase contrast and Bright field) to accommodate experiment requirements and differences in specimen. In this study I demonstrated that the fluorescence mode will be a very useful tool to image bacteria, biofilm and zooplankton (*Artemia salina* and *Daphnia magna*) in combination with various fluorescent dyes such as BODIPY, Live/ Dead stain and biofilm stain (Alexa350-Wheat Germ Agglutinin). In addition, I was successful in imaging GFP (Green Fluorescent Protein)-expressing *Escherichia coli* cells ingested by *Artemia salina* and *Daphnia magna*.

#### HEATING AND COOLING OF A BUILDING

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Using Newton's law of cooling, a mathematical model was constructed to describe the 24-hr temperature profile inside a building as a function of the outside temperature, the heat generated inside the building, and the furnace heating or air conditioner cooling. We explored how long it takes to change the building temperature substantially. We also investigated how the building temperature was varied when the furnace was turned off and when it was on. Although the thermostat was fixed

at a certain temperature, but since the outside temperature was very low, inside temperature could not reach the thermostat temperature.

#### SELF-STABILIZING MASTER-SLAVE TOKEN CIRCULATION ALGORITHM IN AN UNDIRECTED RING OF ARBITRARY SIZE AND ITS ORIENTATION

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Token circulation is a fundamental task in the distributed systems. In this paper, we propose a constant space self-stabilizing master-slave token circulation algorithm for an undirected ring of arbitrary size. We consider the recently introduced and studied master-slave model where a single node is designated to be a master node and other nodes are anonymous slave nodes. The expected stabilization time is  $O(n \log n)$  steps, and the space requirement at each node is 4 bits for any undirected ring of size  $n$ ; the nodes do not need the knowledge of the size of the ring and hence the protocol is suited for dynamic rings. The proposed token circulation algorithm is further extended to achieve ring orientation. Disregarding the time for stabilization, the ring orientation can be done in at most  $3n-1$  steps with 1 bit extra storage at each node.

#### ELUCIDATION OF A NOVEL ALTERNATIVE RNA SPLICING MECHANISM IN MAMMALIAN CELLS

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The aminoacyl-tRNA synthetases are a family of enzymes that link specific tRNAs to their cognate amino acid for protein synthesis. Leucyl-tRNA synthetase (LeuRS) is a class-I synthetase that aminoacylates up to six tRNA isoacceptors. It is also a splicing co-factor in the yeast mitochondria. The canonical core of LeuRS is comprised of a Rossmann fold that contains an aminoacylation active site. LeuRS also has a second domain called the connective polypeptide (CP1) that houses a hydrolytic editing active site. The CP1 domain as well as specific sites on the main body of LeuRS are important to RNA splicing in the yeast mitochondria. The human cytoplasmic LeuRS enzyme is a structural cousin of the yeast mitochondria LeuRS enzyme and therefore may share some similar enzymatic functions. Unpublished data has recently shown that the human cytoplasmic LeuRS enzyme is shuttled into the nucleus of HeLa cells, its function in the nucleus remains unknown. In addition, yeast 2 hybrid assays have indicated that human cytoplasmic LeuRS forms protein-protein interactions with SC35 and SRcyp. SC35 and SRcyp play integral roles in RNA splicing and maturation processes. We have demonstrated that human cytoplasmic LeuRS has specific protein-protein interactions with SC35 and SRcyp. These enzymatic complexes may influence RNA processing in the nucleus and therefore explain why human cytoplasmic LeuRS is shuttled into the nucleus. Based on these biochemical findings, we hypothesize that human cytoplasmic LeuRS, SC35 and SRcyp form specific interactions that influence RNA processing and maturation with the nucleus of mammalian cells.

#### SATISFACTORY HIGHWAY CRUISING SPEED OF A VEHICLE

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Based on the speed versus MPG curve and data, the satisfactory highway cruising speed of a vehicle is found by using the backward difference method and the operations research model. This speed is a smart compromise between fuel economy and highway speed limit.

#### USING MICROBIAL SOURCE TRACKING TECHNIQUES TO IDENTIFY FECAL INDICATOR BACTERIA IN THE HORSE CREEK WATERSHED IN AIKEN, SC

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The presence of fecal pollution in water bodies is a significant health concern. Contamination can result in infectious disease outbreaks and ultimately death. In 2005, the Environmental Protection Agency (EPA) released a report which concluded that the Total Maximum Daily Load (TMDL) present in Horse Creek exceeded the determined water quality standard. Wildlife, grazing animals, failing septic systems, and urban nonpoint sources were listed as potential sources of fecal coliforms. In 2011, our lab initiated a preliminary study to examine the number of coliforms present upstream of the waterway. We identified several sites in which high numbers of colony forming units (cfu) per milliliter of surface water were present. However, the presence of coliforms does demonstrate the presence of fecal indicator bacteria. Recently, our lab has initiated a study to determine if fecal indicator bacteria are present in the Horse Creek watershed. More specifically, water samples are analyzed for the presence of *Escherichia coli*, an established indicator of fecal contamination. Initially, collected water samples are screened for the presence of *E. coli* using culturing techniques. *E. coli* contains an enzyme called  $\beta$ -glucuronidase that converts the substrate 4-methylumbelliferyl- $\beta$ -D-glucuronide, which is present in the culturing media, into a fluorescent product that can be detected with a UV light. Promising samples are cultured further, and their genomic DNA is isolated and analyzed to determine if specific molecular markers are present. Based on previously published reports, the *uidA* and *LacY* genes can be used to identify *E. coli*. DNA from individual isolates is analyzed for the presence of both molecular markers. Samples in which both *uidA* and *LacY* are present are identified as *E. coli*.

## EMBRYO TRANSFER (ET) FACTORS AFFECTING CLINICAL PREGNANCY RATES: A UNIVARIATE ANALYSIS

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Embryo transfer (ET) is thought to be the most critical and inefficient step in assisted reproduction technology (ART). While high rates of fertilization occur in a laboratory setting, the overall ET procedure has comparatively low success rates. This has led investigators to concentrate on the specific steps involved in ET. Factors identified as having clinical importance to ET include: transfer depth, catheter type, and transfer physician. Medications taken in conjunction with estrogen injections are also a potential factor in pregnancy outcome. This study attempts to evaluate the difference in pregnancy rate among physicians that performed embryo transfers. Other variables that are investigated are catheter type and transfer time between physicians, medication interaction, and estrogen levels on the day of oocyte retrieval. This retrospective cohort study was conducted at an ART laboratory in a tertiary-care, university hospital. Pregnancy rates (PR) were not different based on medications, estrogen levels, or prior history of pregnancy or delivery. The PR were also not different based on transferring physician, but a trend toward higher pregnancy rate was noted when the transfer was performed at the full depth of the mock embryo transfer compared to 0.5 cm or greater below than the depth of the mock transfer. In conclusion, ultrasound-guided embryo transfer yields clinically similar results among physicians following a standardized transfer protocol. Medications for medical co-morbidities, estrogen levels, gravidity nor parity caused a clinically significant difference in pregnancy rate. Depth of transfer compared to depth of mock transfer maybe an important factor worthy of further study.

## STIs: ARE THE YOUTH OF TOMORROW PREPARED FOR THE INFECTIONS OF TODAY?

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Sexually transmitted infections (STI's) are infections primarily passed from one person to another through sexual contact. There are more than 30 different bacteria, viruses, and parasites that cause STI's. College students are at particular risk of contracting STI's. The presence of untreated STIs (both those which cause ulcers and those which do not) increase the risk of both acquisition and transmission of HIV by a factor of up to 10. The objectives of the present study were to collect quantitative and qualitative data about student's knowledge of STI's through a survey and interviews and then produce educational materials specific for the group that was surveyed. The survey was constructed based on questions students created and a review of literature of other surveys conducted among college students and distributed among 100 students at the USC Sumter. Convenience sampling was used and participation was voluntary with no identifiers from the participants. All students signed a consent form. Ninety-one percent of the respondents ranged in age from 18-24. The female to male ratio was 1:1.5. Seventy-four percent of the respondents were from Sumter County. The main sources of information regarding STI's were obtained from sex-education in school (79%) and internet (54%). Even though students were aware of that STI's can cause infertility, they were unaware that STI's can cause cancer, and damage to the liver and brain. Seventy percent of the students were not aware of the risk of contracting STI's through oral intercourse, and 33% were unaware that alcohol and drug use could pose as potential risk factors for STI's. Participants reported that teen pregnancy (75%) and STI's other than HIV (69%) were problems in their community.

Students indicated that they were aware of common STI symptoms and modes of transmission, but 55% of the students surveyed indicated that they needed additional information on STI's and resources to provide support. Based on the surveys and interviews with students, a pamphlet and other educational materials have been produced so that students can obtain the necessary information for STI detection, prevention, and treatment.

## CULTURAL INFORMATICS: AN IMAGE-BASED EXPLORATION

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Morris College

As the saying goes, "A picture is worth a thousand words." But, image understanding is still a challenging area that it is hard to cast as an information retrieval problem. There is some cognitive magic that researchers are trying to capture as software. In this project, we asked the question how a computer can see an image as a thousand words. Our goal was to build a tool that will automatically hypothesize a textual context out of a picture. Our particular focus was towards "Cultural Informatics." We collected images based along several dimensions such as arts, cuisine, architecture, sports, traffic, education, etc. from several countries across the world. We generated a relatively small database of images and tagged those images with these dimensions and geographic location as key words. We also imported the entire Wikipedia database to serve as textual context for this project. Our data collection and organization's work supports the algorithm development for linking image similarity and textual similarity to generate a new hypothesis and textual context for any new user-uploaded image. The images that we collected as part of the project serve as ground work for machine learning algorithms to draw inference about unseen user-uploaded images.

## FACTORS INFLUENCING THE GERMINATION OF DIMORPHIC SEEDS IN *AEGILOPS TRIUNCIALIS*.

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Non-native grass species are among the most problematic plants in most invaded habitats. They typically show a high degree of phenotypic plasticity and may be successful invaders because of plastic germination behavior. We tested the strength of germination inhibitors in *Aegilops triuncialis* (barbed goatgrass) and whether they varied between three populations from the same region. *A. triuncialis* (barbed goatgrass) is an invasive species of annual grass from the Mediterranean Basin with very low population genetic variation that was first reported in California in the early 1900's. The flowering spikes of goatgrass contain 5-7 spikelets which contain 1-2 seeds each. In a seed pair, the smaller seed is typically less dormant when the large seed has been removed or when the spikelet has been washed repeatedly. We tested seed dormancy by washing spikelets in DI water, or by removing the large seed, or both. We planted 200 spikelets in seedling tubes and then placed them into a growth chamber set at 20C and 10C for 12 hours each day for a period of 14 days. We found significant increases in emergence of the small seed when the large seed was removed and/or washed indicating that both a sibling effect and a maternal seed effect may influence germination. Sibling and maternal effects may affect small seed dormancy which can contribute to the invasiveness of the species by creating a large seed bank which can lay dormant during drought conditions and emerge later under better conditions. The variation among genetically similar populations reflects strong plastic responses to the environment that may be important in the invasive success of this species.

## PREPARATION OF CURCUMIN AZOLES FROM TRILITHIATED HYDROXYACETOPHENONE OXIMES OR TRILITHIATED HYDROXYACETOPHENONE HYDRAZONES AND VARIED ESTERS INCLUDING COUMARINS

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Select acetophenones, such as 2-hydroxyacetophenone can be easily transformed to their oximes or phenylhydrazones or carbomethoxyhydrazones. These entry compounds were trilithiated with excess lithium diisopropylamide (LDA), and the resulting polyolithiated intermediates were condensed-cyclized with a variety of benzoate esters including (lithiated) hydroxybenzoates, coumarins, and other esters. Dihydroazoles are targeted for the condensation-cyclization of these trilithiated nucleophilic intermediates with benzaldehydes including lithiated hydroxybenzaldehydes and should result in dihydroazole products that would be excellent candidates for X-ray crystal analysis and biological evaluation at the Medical University of South Carolina.

## THE ROLE OF GALECTIN-3 IN MACROPHAGE-LEYDIG CELL INTERACTIONS

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Galectin-3, a beta-galactosidase-binding protein (30-35 kDa), belongs to a 15-member family of animal lectins. Extracellular galectin-3 has been proposed to mediate cell adhesion whereas intracellular galectin-3 acts as a signaling molecule to regulate the cell cycle, apoptosis, and mRNA splicing. Using immunohistochemistry, we examined the developmental distribution of galectin-3 in the rat testis. We have demonstrated that galectin-3 is localized to the gonadal macrophage. In this research we hypothesized that galectin-3 is responsible for the interaction between gonadal cells and macrophages. This idea is supported by well-established data that testicular macrophages contribute to Leydig cell steroidogenesis by direct interaction. We, therefore, have evaluated the role of galectin-3 antibody in Leydig cell (MA-10 cells) and macrophage (RAW 264.7 cells) adhesion by using a cell-cell adhesion assay. We co-cultured the mouse MA-10 cells and RAW cells and evaluated their adhesion in the presence of galectin-3 antibody. In vitro adhesion assay was performed by using 5µg/ml BCECF-AM [2', 7'-bis-(2-carboxyethyl)-5-(and-6)-carboxyfluorescein, acetoxymethyl ester] labeled MA-10 cells. The BCECF-labeled single MA-10 cells were added to the attached RAW cells in the absence (1 µg/ml IgG) or presence of galectin-3 antibody (1 µg/ml, 0.5 µg/ml or 0.1 µg/ml). The fluorescence intensity was measured by using a microplate fluorescence analyzer (Cary Eclipse) at 485 and 530 nm wavelengths. We co-cultured the mouse MA-10 cells and RAW cells and evaluated their adhesion in the presence of galectin-3 antibody. Our results showed that anti-galectin-3 antibody at all three concentrations tested inhibited cell adhesion (Leydig cell binding to macrophages) significantly as compared to the IgG control. This study will help us not only to better understand the function of galectin-3 in cell-cell interactions, but also it will add immense value to recognize the role of galectin-3 in modern cancer biology and therapeutics (partly supported by a 2012 SCICU grant).

## MEASUREMENT OF ANTI-MULLERIAN HORMONE AND INHIBIN B AS FERTILITY INDICATORS IN SAND DOLLARS AND DEER

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Human and environmental- caused stressors affect wildlife populations in a number of ways, some more critical than others. One of the major effects can involve the success rate of fertility and reproduction. The effects of toxins on wildlife can be difficult to ascertain and, usually, harder to remedy. Once toxins enter the environment, they accumulate in the food chain, affecting all levels of the ecosystem (Wildlife conservation society). This is critical for endangered and other protected species, for scientists to understand whether reproduction is being impaired, and if it's possible to decrease the stressors that may be the cause of the impairment.

Marine invertebrates, such as Sand Dollars, are time honored models for comparative investigations in reproductive biology. Effects of stressors have been very difficult to evaluate using traditional methods. The inability of scientists and managers to demonstrate clearly the magnitude and extent of effects of environmental stressors such as climate change, red tides and contaminants on marine animals represents a significant impediment to their conservation.

We are testing the use of a chemical test (a biomarker in the form of specialized assays) that measures fertility potential of male and female humans and appears to do so for other animals. A test of clam and oyster gonadal tissue demonstrates that the assays work for these species. Our assay could dramatically affect both what we know regarding effects of stressors, and the urgent actions for effective and cost-effective conservation. These assays are associated with captive breeding programs zoos and aquariums worldwide; such programs can be important complement to conservation programs conducted in the field. These biomarkers have potential for us to learn more about the reproductive capacity of invasive species which could result in programs to help eliminate their populations.

#### FIBROBLAST CELL GROWTH INHIBITION BY INSULIN-LIKE GROWTH FACTOR RECEPTOR INHIBITOR

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In response to cell injury, signaling pathways of a variety of peptide growth factors are activated in order to repair the injured tissue. Uncontrolled cell proliferation and matrix protein accumulation during the repair process lead to scar tissue formation. Effective inhibitors against well-known mediators of fibrotic proliferation such as Platelet-derived growth factor (PDGF) and Transforming growth factor beta 1 (TGF $\beta$ 1) are reported as potential therapeutic agents to combat fibrotic cell proliferation leading to diseases such as Pulmonary fibrosis (PF). However, the role of the peptide growth factor Insulin-like Growth Factor-1 (IGF-1), a potent regulator of cell proliferation and induction of matrix protein production is not well researched as a possible mediator of PF. Inhibition of the IGF-1 signaling pathway can be targeted to inhibit cell proliferation as well as to restore apoptosis in fibrotic tissue. To characterize the role of IGF-1 and IGF-1 receptor (IGF-1R) in fibrotic cell proliferation, experiments are carried out to inhibit IGF-1R in 3T3 cells, a mouse fibroblast cell line. An inhibitor of the kinase domain of IGF-1R, NVPADW742 (NVP), and an inhibitor of mammalian target of Rapamycin (mTOR), a downstream effector of the PI3Kinase cell signaling pathway (which is affected by IGF-1 signaling), RAD 001 (Everolimus, EVE) are used to monitor cell growth. In order to determine optimal concentrations of the inhibitors, 0.1 $\mu$ M, 0.5 $\mu$ M, 1 $\mu$ M, and 5 $\mu$ M of NVP and 1nM, 5nM, 10nM, and 20nM of EVE were used in MTT cell growth assays and it was found that the most effective inhibition occurred at concentrations between 1 $\mu$ M and 5 $\mu$ M of NVP and 10nM of EVE without being toxic to the cells. Current studies are focused on monitoring the levels of PI3Kinase cell signaling pathway proteins to further assess the effect of combination drug treatments.

#### EFFECTS OF INHIBITION OF PROTEASOME AND MITOGEN ACTIVATED KINASE (MAPK) PATHWAYS ON CELL VIABILITY IN BREAST CANCER

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Despite significant advances in methods of treating breast cancer and the successful use of anti-estrogen therapies there is still a need for additional treatment interventions especially for aggressive estrogen insensitive subtypes such as the “triple negative” basal cell-like cancer. Our objectives were to investigate the effects of (1.) MG-132, an inhibitor of the ubiquitin-proteasome system (UPS) and (2.) PD98059 an inhibitor of the MAPK kinase on induction of cell death in breast cancer cells. The MTT Assay was used to measure cell vitality based on mitochondrial function. Cells from two estrogen responsive, luminal-type breast cancer lines (MCF-7 and T47d) and from the “triple negative” basal cell-like MDA-MB-231 line were seeded in 96-well plates and treated with +/- Mg-132 (10 $\mu$ M) and +/- PD98059 (40  $\mu$ M) for 24 hours then assayed for relative viability. Analysis of variance (ANOVA) and mean separation tests were performed using CoStat software (n = 12,  $\alpha$  = 0.05). Results showed that inhibition of the proteasome significantly reduced MTT product in each cell line. Treatments with PD98059 resulted in significant reductions of MTT product for estrogen responsive MCF-7 cells and “triple-negative” MDA-MB-231 cells, but not for estrogen-responsive T47d cells. 2-way ANOVA showed interactions that could represent alternative utilization of MAPK pathways in the different cell lines. These results demonstrate potential effectiveness of proteasome inhibition as an adjuvant therapy for both estrogen-sensitive and insensitive carcinoma of the breast. Further study is necessary to define possible cross-talk between the UPS and MAPK systems in breast cancer.

#### ANTIPROLIFERATIVE ACTIVITY OF RASPBERRIES ON TWO HUMAN BREAST CANCER CELL LINES

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It has been proposed by previous studies that certain compounds in fruits may be able to provide cancer fighting properties without the negative impact of current treatments. This study expanded the proposed hypothesis on the American raspberry (*Rubus Idaeus*), a fruit rich in the phytochemical ellagic acid; a documented anti-carcinogen.

The effects of artificially digested freeze-dried raspberry extract and extract from a raspberry supplement tablet were separately evaluated against the human mammary adenocarcinoma estrogen receptor positive (MCF7) or estrogen receptor negative (T47D) cells. Cell cultures grown to a density of 2\*10<sup>5</sup> cells/ml, were exposed to raspberry concentrations of 0%, 10%, 12.5%, 25%, and 50% for 24 hours. Raspberry and pill extracts inhibited growth of MCF7 cells, in some cases up to 50%. A significant difference in proliferation was observed when comparing MCF7 cells cultured in growth media alone and cells

exposed to raspberry extracts ( $p < 0.001$ ). In contrast, the T47D cells appear to have a higher growth rate when exposed to raspberry extracts compared to the control. Raspberries may prove to be an effective fruit to inhibit specific types of breast cancer, but additional studies need to be done to support our findings.

## OBSIDIAN: PATTERN-BASED UNIT TEST IMPLEMENTATIONS

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Software test engineers working with the Java language have in recent years gravitated to the automated generation of unit, or method, tests for Java classes. There now exist many automated testgenerator tools with the primary task of generating test cases, comprised of inputs and a corresponding oracle, each of which is explicitly paired with a specific supporting test implementation. The authors posit that this explicit pairing, or conflating, of test implementation with test case is unnecessary and counterproductive. The authors address this problem by separating the conflated concerns into two distinct tasks: 1) instantiating test implementations and 2) instantiating test cases. This paper focuses on automating the first task in support of the second with the goal of freeing the test engineer to concentrate on test case instantiation. The authors present a new opensource testpreparation tool Obsidian that produces robust, comprehensive, and maintainable unit test implementations. Obsidian, built on the JUnit framework, uses a set of `\emph{context patterns}` and associated algorithms combined with information from the Java Reflection API to generate these unit test implementations from Java byte code. These context patterns guide Obsidian to prepare test implementations that guarantee compilation, support exception handling, enable multiple test cases when required, and provide a suitable location for assertions about the test case outcome(s). Obsidian supports regression testing and testdriven development through its novel audits of the testing process.

## IDENTIFICATION OF SUBCELLULAR MOLECULAR TARGETS OF THE ALGAL BIOTOXIN, AZASPIRACID

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Some Harmful Algal Blooms (HABs) produce polyether toxins called azaspiracids (AZA). These compounds have been known to accumulate in various shellfish species. In the event of human intoxication through consumption of AZA-contaminated shellfish, symptoms such as nausea, vomiting, diarrhea, stomach cramps, and headaches may result. However, no deaths have been recorded. The potential for AZA intoxication is compounded by the presence of toxin-binding proteins, which are responsible for their slow rate of depuration in certain shellfish species. Furthermore, the mechanisms of action for this toxin class and its biological receptor have not been identified. In this study, we used Surface Plasmon Resonance (SPR) technology to begin the process of identifying potential subcellular molecular target(s) for AZA toxins. Subcellular protein fractions from Jurkat T lymphocyte cells, BE (2)-M17 neuroblastoma cells, and Caco2 colon epithelial cells were used. For all cell lines, the pellet extract containing cytoskeletal proteins bound with high specificity to AZA1 toxin, although the absolute binding responses were low indicating a weak interaction. In addition, an equal level of AZA1 interaction with proteins from the membrane extract was observed (~ 20% binding inhibition). This was either due to binding resulting from the non-specific interaction between the lipophilic AZA1 and the hydrophobic membrane lipids, or the presence of a membrane protein. For the cytoplasmic extract and chromatin-bound extract, significant AZA1 binding was observed only for the BE (2)-M17 and Caco2 cells, respectively. However, these different protein extracts will have to be fractionated and analyzed further to locate and identify the specific binding partners for AZA1.

## SYNTHESIS AND BIOLOGICAL EVALUATION OF NOVEL CHEMOTHERAPEUTIC PHTHALAZINONE ANALOGS ON PROSTATE CANCER

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Modern cancer chemotherapeutic treatments are cytotoxic to cancerous cells and healthy cells, causing dangerous side effects that lead to more harm than the cancer itself, thus more selective anti-cancer agents are needed. In collaboration with MUSC, we designed three compounds (phthalazinones) for targeted synthesis by first designing and utilizing an activity relationship modeling technique based on combretastatin A-4 (CA4) and 104 of its known synthesized derivatives. CA4 is a chemotherapeutic drug used in late-stage thyroid cancer. It induces cell death by binding to the colchicine binding site, a globular protein, within a cell's microtubules disrupting mitotic activity. The three designed novel anticancer compounds have been predicted, based on this computer model, to be potent against tumor cells. Current results show all three phthalazinones display anticancer activity against prostate cancer cells (DU-145), and two of them show minimal to no cytotoxicity to non-proliferating healthy C60 neuroblastoma brain cells.

## GENETIC MAPPING OF A NOVEL MICRORNA TRANSLATIONAL REGULATION MUTANT IN PLANTS

Michele Howard and Charlotte Song

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Recently, small RNAs have been found to be significant in regulation in eukaryotes. MicroRNAs (miRNA) are a class of small RNAs. In plants, cleavage is believed to be the main mode of regulation by miRNAs, but recently translational regulation has

been found also to be playing a role. We have generated transgenic plants with an artificial miRNA targeted to *chalcone synthase (CHS)* in *Arabidopsis thaliana*. *CHS* is an ideal gene to study because it is involved in the synthesis of anthocyanins, which are easily observable under certain experimental conditions. We introduced a nucleotide loop out in the target to prevent cleavage and shifted the regulation to translational repression. Then, we generated EMS mutants to find signaling components involved in translational repression of miRNA targets. The EMS pools were screened for suppression mutants. The mutants were collected and crossed to a different ecotype of *Arabidopsis thaliana* to generate a mapping population. In the laboratory, I have collected seeds, planted mapping populations, extracted DNA samples for one of the mutants. We are currently mapping the mutant to find the mutated gene. The mutant I am studying does not have any distinguishable phenotypes, and it does not have any overlapping phenotypes with known miRNA mutants. It is likely to be novel mutant.

#### THE DEVELOPMENT OF PROGNOSTIC MARKERS IN PANCREATIC CANCER

Tiesha James  
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Pancreatic cancer carries with it a poor prognosis. This is due to the fact that early stages of the disease are symptom-free. Most cases are, therefore, diagnosed at later stages. Without active treatment, the survival rate is around 6 to 10 months which extend to around 18 to 20 months with proper treatment. Because the diagnoses are detected extremely late, more than 80% of the cancers are not treatable (with surgery). Although diagnostic methods are becoming more advanced every year, estimates show that 43,920 people will be diagnosed with pancreatic cancer in the year 2012, and there will be 37,390 deaths. Statistics show that pancreatic cancer is the 4th overall cause of cancer-related deaths in the United States

#### SOLVENT-DIRECTED ASSEMBLY OF POLY(3-HEXYLTHIOPHENE) AGGREGATES

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Controlling phase separation and fabricating regular assemblies of dissimilar compounds into optimal domains over extended length scales is one of the principal challenges in the field of functional materials. In particular, the morphology of benchmark poly(3-hexylthiophene)/nanoparticle bulk-heterojunction (BHJ) composites is well-known to impact their performance in optoelectronic and photovoltaic devices. Current approaches for thin-film deposition promote poly(3-hexylthiophene) (P3HT) crystallization, but they can also induce unfavorable phase separation of the P3HT/nanoparticle BHJ composite. Recent research suggests that metastable aggregate and microcrystalline precursors in solution can significantly impact the morphology of polymer thin films. Our research is specifically concerned with the formation of well-ordered P3HT aggregates, called J-aggregates, and their attendant assembly into larger nanofibrillar structures that can act as sites for nucleation and growth of extended crystalline networks in P3HT thin-films. We will present our initial findings using a variety of solvent systems of varying P3HT solubility to induce polymer aggregation. In addition, Spano analyses of steady-state absorption spectra were used to reveal the interplay between the structural order of the aggregate order and the excitation coupling strengths within the P3HT assemblies and their dependence on the solvent properties.

#### EFFECT ON CELL VIABILITY OF PROSTATE CANCER CELLS FOLLOWING CERAMIDE/CHLOROQUINE COMBINATION TREATMENT

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Ceramide, produced in cellular response to stress, is a component of sphingolipids which function structurally in lipid membrane and in signaling processes such as differentiation, proliferation and apoptosis (programmed cell death). Acid ceramidase (AC) is a lysosome localized enzyme responsible for degrading ceramide in the cell. Previous work has observed that AC is over-expressed in prostate cancer cell lines and in primary tumor sites, thus contributing to resistance to chemotherapeutics and radiation treatments. This is due to AC conversion of ceramide, a pro-apoptotic molecule, into sphingosine. This allows a sphingosine kinase to phosphorylate sphingosine into sphingosine-1-phosphate, a pro-survival molecule. This suggests that the increased metabolic degradation of ceramide by over-expression of AC allows a cancerous cell to escape ceramide-induced apoptosis, thus providing a potential target for cancer treatment options to be studied. Additionally, previous work has shown that due to the lysosomal localization of AC in a cell, pre-treatment with the FDA approved anti-malarial drug chloroquine, which has destabilizing effects on the lysosome, can increase cell sensitivity to ceramide-induced apoptosis. The focus of present research has been to further confirm the link between AC over-expression and cell viability, and to determine an effective dosage ratio for possible options utilizing chloroquine to increase cell sensitivity to ceramide inducing treatments.

#### ENVIRONMENTAL SCIENCE EDUCATION AT ALLEN UNIVERSITY

Tomohiro Kawaguchi, Ph.D.  
Department of Biology, Division of Mathematics & Natural Sciences, Allen University

Allen University has made tremendous improvement in Environmental Science Education the past three years with funding from the Department of Energy-Environmental Management grant. We conducted a Summer Science Institute in 2009 for 20 incoming freshman to boost their readiness for the first semester at the university. Academic performance of these 20



students was carefully monitored for two years with frequent academic advising. We hired two faculty members for two semester general biology courses to strengthen student's basic understanding of biological concepts. Use of Handheld instrument, LabQuest, equipped with GPS was implemented in Introduction to Environmental Science lab. to monitor environmental quality such as temperature, pH, conductivity, oxygen and carbon dioxide in air and dissolved oxygen (DO). A live snake presentation by a specialist was implemented in General Biology and Ecology in order for students to understand the ecosystem concept. Our university is the first university in the southeastern U.S. to house a new generation microscope, Olympus Bio Imaging FSX100, in Environmental Science Education so that students can enjoy taking beautiful images of specimens without getting intensive training. Students in Internships in Environmental Biology benefit tremendously from getting individual training. Our outreach program for both middle and high school teachers as well as students have been well received by local communities and have been training future scientists for environmental management.

## PROOF (ALMOST) WITHOUT WORDS: CONIC SECTIONS

Philip Lynwood Kears  
USC Salkehatchie

The traditional definition of a conic section in geometry is a curve obtained as the intersection of a cone with a plane. In this talk I will use Dandelin spheres to show that the curves obtained in this definition are equivalent to the ones introduced in our Calculus class: in a plane, the set of points that are equidistant from the directrix and the focus is a parabola, the set of points that has a constant sum of the distances between the point and two foci is an ellipse, and the set of points that has a constant difference of the distances between the point and two foci is a hyperbola.

## IN-VITRO STUDIES OF NEWLY SYNTHESIZED PHTHALAZINONE CHEMOTHERAPEUTICS

Kimberly Klas<sup>1</sup>, Brett Hoover<sup>1</sup>, Brenna Norton-Baker<sup>1</sup>, Justin Wyatt<sup>1</sup>, Yuri Peterson<sup>2</sup>, Craig Beeson<sup>2</sup>, and Gyda Beeson<sup>2</sup>

<sup>1</sup>Department of Chemistry and Biochemistry, College of Charleston

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Current cancer chemotherapeutics are cytotoxic not only to cancerous cells but also toward normal cells. This is a dangerous side effect that may potentially compromise the mortality of cancer patients more than the cancers themselves. Thus, chemotherapeutic regimens are needed with greater specificity towards rapidly dividing cancer cells and decreased targeting of normally dividing cells. We have designed three compounds utilizing a phthalazinone core for targeted synthesis based a 2D-qualitative structure activity relationship (QSAR) study on combretastatin A-4 (CA-4) and 104 of its known derivatives that was developed in collaboration with Dr. Yuri Peterson at the Medical USC (MUSC). (CA-4 is a chemotherapeutic regimen used in late-stage thyroid cancer, and its mechanism of action is via inhibition of mitosis by binding to a cell's microtubules, leading to cell death.) These phthalazinones have been synthesized and are being tested *in vitro* in collaboration with Dr. Craig Beeson at MUSC, specifically against prostate cancer cells (DU145), along with relative cytotoxicity using a neuroblastoma C60 brain cells. Results clearly show activity and specificity in the cancer cells while showing minimal to no cytotoxicity to nonproliferating cells. Future work entails an in-cell analysis to visually evaluate the mechanism action and the beginning synthesis of the next generation of anticancer phthalazinones.

## THE SUBARU SEEDS IMAGING SEARCH FOR EXOPLANETS AROUND HIGH-MASS STARS

Thea Kozakis

Department of Physics and Astronomy, College of Charleston

I present a status report on the Subaru SEEDS sub-program to search, via direct-imaging, for extrasolar planets around high-mass (mostly) early results, including the discovery of a 'Super-Jupiter' around the late B-type star  $\kappa$  Andromedae. SEEDS, the Strategic Explorations of Exoplanets and Disks with Subaru, is a multi-year, direct-imaging survey to explore the link between planets and disks, and the evolution of planet-forming star systems and debris disks. It is an international project approved by National Astronomical Observatory of Japan (NAOJ) and led by principal investigator Motohide Tamura. The SEEDS team is comprised of over 25 institutes with more than 100 members participating. With first observations carried out in 2009, the high-mass star sub-program uses the Subaru 8-meter Telescope, adaptive optics, and a near infrared imaging science camera (HiCIAO) to search for exoplanet signatures. As of now, my colleagues and I have observed 28 targets made up of 2 B stars and 26 A stars.

## THE PRESENCE OF GLYPHOSATE-RESISTANT WEED SEEDS IN COMMERCIAL POTTING SOILS

Katherine I. Layne and Andy Dyer

Department of Biology & Geology, USC Aiken

The emergence of glyphosate-resistant weeds is an increasing problem for farmers and landowners across the country. Weeds can become resistant to glyphosate (Roundup®) either by natural selection for a mutation conferring resistance or by acquiring a crop transgene for reduced glyphosate translocation. Once weed populations become resistant, their movement across the landscape into non-resistant populations a very real additional concern. One potential mechanism for the unintentional movement of glyphosate-resistant weeds is through the commercial potting soil industry. These products are packaged at large production facilities, distributed throughout the region, and sold at a large number of retail outlets. The products are marketed with the assumption that they are weed-free, but we have grown and identified nearly 100 species from the most

common brands of low-quality, inexpensive potting soils and topsoils. In this experiment, eight different brands of these low-quality, inexpensive products (<\$2.50/40# bag) were tested for the presence of weed species. Four brands contained sufficient numbers of weeds to be tested for glyphosate-resistance. Sixty-nine plants of eight different species were sprayed with 2% glyphosate and then observed. Although most plants died quickly, individual plants of several species either died slowly or not at all. This experiment suggests that commercial suppliers of low-quality, inexpensive topsoils and potting soils may be responsible for spreading glyphosate-resistant genotypes of common weed species into areas where they did not previously exist. The movement of these plants poses a potential threat to agriculture in those areas.

## ONLINE SERVICE FOR CONVERTING COMMAND LINE PROGRAM INTO WEB SERVICE

Jiao Li

School of Computing, Clemson University

The increasing requirements of a diversified wealth of applications promote the growth of the Internet in terms of users and bandwidth. There are so many diversified web services available on the Internet, which are developed by groups or companies. But there is no platform which allows people to convert their personal programs into web service. Some talented people may develop some interesting programs by themselves or find some useful programs, and want to convert it to a web service, so that more people can access it. But individuals don't have good financial foundation to support deploying his programs at a public server and making more people to use it. So we have developed this kind of platform, so that people can upload their programs via our system, we convert them to web service, and allow others enjoy these web services via our website. Users just need to enter the input parameters on the website and wait to get the result from our website via email. Then subscribers don't need pay extra money to convert their program to web service and maintain it on the internet. This may also be used to synchronize users' own programs, so that they can run it wherever they are and don't need to configure the new system environment. We believe this is the first available tool for converting individual programs to web service. We can use it to publish our programs to the rest of the world. For developing this web application, we are using Django framework based on Python, running on Apache, and MySQL database.

## D-AMINO ACID INHIBITORY PROPERTIES ON BACTERIAL GROWTH

Kayla Liland, McKynsey Douglas, and Paul E. Richardson

Department of Chemistry and Physics, Coastal Carolina University

Humanity is slowly falling behind in the battle against bacterial infections. Antibiotic effectiveness is on the decline due to increasing resistance; new methods for fighting bacterial infections are a necessary to continue to stay ahead of the bacterial resistance. One method we are pursuing is the use of d-amino acids to inhibit growth. The d conformation of amino acids is very rare and the mirror image of the l-amino acid, the normal conformation found in almost all proteins. The mirror conformation is sometimes used in bacterial cell walls and would cause difficulty in normal protein function if incorporated into a protein. With this knowledge, the d-amino acids lysine, arginine, glutamic acid, methionine, isoleucine, and leucine will be utilized in an effort to observe the possible inhibitory effects on the bacterial growth of *staphylococcus aureus* and *Escherichia. coli*.

## DEBLURRING IMAGES USING SINGULAR VALUE DECOMPOSITION

Wei-Fang Liu

Department of Mathematics and Computer Science, The Citadel

The goal of this project is to develop efficient methods to recover a blurry image which is affected by unknown noise using a linear algebra approach. Consider a recorded  $m \times n$  blurred image  $B$  in a linear model, that is, there exists a blurring matrix  $A$  and a noise matrix  $E$  such that  $\text{vec}(B) = A \text{vec}(X) + \text{vec}(E)$  where  $X$  is the original image and

$$\text{vec}(C) = \begin{bmatrix} C_1 \\ \vdots \\ C_n \end{bmatrix} \text{ where } C_i \text{ is the } i \text{ th column of } C. \text{ Let } A_k = \sum_{i=1}^k \sigma_i u_i v_i^T \text{ where } \sigma_1 \geq \sigma_2 \geq \sigma_3 \geq \dots \geq \sigma_k > 0$$

are singular values of  $A$  and  $(u_i, v_i)$  be the pair of left and right singular vectors associated to the singular value  $\sigma_i$  for  $i = 1, \dots, k$  and  $k$  is less than the rank  $r$  of  $A$ . We deblur the image  $B$  by  $B_k$  where  $\text{vec}(B_k) = A_k^\dagger \text{vec}(B)$

and  $A_k^\dagger = \sum_{i=1}^k \frac{1}{\sigma_i} v_i u_i^T$ . We have developed an algorithm that determines a value  $1 \leq k \leq r$  such that the deblurred

image  $B_k$  is closest to the original image  $X$  in the sense that the difference  $\|B_{k+1} - B_k\|_2$  is the smallest.

## ECOTOXICOLOGICAL ASSESSMENT OF GILLS CREEK WATER QUALITY

Amber D. Lloyd

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Sandra Steingraber, author of *Living Downstream*, wrote in the forward of her book, "Of the 80,000 synthetic chemicals now in use, only about 2 percent have been tested for carcinogenicity and, since 1976, exactly five have been outlawed under the Toxics Substances Control Act. Our environmental regulatory system requires no rigorous toxicological testing of chemicals as a precondition for marketing them". Although much water quality improvement of national streams and rivers has been made since the Clean Water Act of 1972, there is still much work necessary to recover the condition of streams and rivers. As a part of independent study "Introduction to Environmental Science", I chose Gills creek watershed as a study site to learn about our local environment. I tested Gills Creek water quality, which is reported as one of the largest impaired urban watersheds in South Carolina using various bioassays. A 1999 United States Geological Survey report found high pesticide levels in Gills Creek, which could be harmful to fish populations and fecal coliform levels that make the creek not "safe for swimming". Four different bioassays were conducted to test Gills Creek water quality. 1) Lettuce seeds, 2) *Daphnia magna*, 3) *Artemia salina*, and 4) eggs of *Artemia salina* were used. For lettuce bioassay, I compared the radicle length of each sprout between Gills Creek water and Distilled water after a 5 day growth period. For *Artemia* and *Daphnia* bioassays, the mortality was compared between Gills Creek water and control (Instant ocean in spring water for *Artemia*, spring water for *Daphnia*) after 24 hours. For *Artemia* eggs bioassay, the hatching rate between Gills Creek water and control water was compared. In this study all bioassays except lettuce seeds bioassay showed that there were no significant differences between Gills Creek water and Control. Results suggest that more sensitive bioassays are needed to develop to assess the toxic condition of Gills Creek water.

## PREPARATION OF PYRAZOLE-BENZENESULFONAMIDES FROM THE CONDENSATION-CYCLIZATION OF DILITHIATED PHENYLHYDRAZONES WITH LITHIATED METHYL 2-AMINOSULFONYL-BENZOATE OR 4-AMINOSULFONYLBENZOATE AND OTHER BENZENESULFONAMIDE ESTERS

Steven A. Luther, Jennifer L. Radke, William G. Shuler, Alton Ray Thomas, Marco Gattoni-Celli, and Charles F. Beam  
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Pyrazole-benzenesulfonamides are being prepared from the condensation-cyclization of dilithiated phenylhydrazones of different C( $\alpha$ )-aldehydes and C( $\alpha$ )-ketones including phenylacetaldehyde, cycloalkanones, indanones, tetralones, additional substituted acetophenones or propiophenones, with methyl 2- or 4-aminosulfonylbenzoate. These products are being characterized by absorption spectra, including liquid chromatography – mass spectrometry (LC-MS), and an X-ray crystal analysis for representative products. Biological evaluation of the products will be conducted at the Drug Discovery laboratories at the Medical University of South Carolina.

## COMPUTATIONAL INVESTIGATION OF GAMMA SYNCHRONIZATION USING OPTOGENETIC MODULATION OF PREFRONT CORTEX

Patrick Lynn, Sorinel A. Oprisan, Antonietta Lavin and Tamas Tompa  
College of Charleston

Neurons usually produce stereotypical oscillatory patterns (called action potentials - AP. When the incoming APs and the intrinsic oscillatory properties of the afferent neuron match then resonant effects occur that allow a rapid spread of synchronous activity over a large area of the brain. Such large-scale cortical oscillations are observed over many frequency bands. Experiments were carried out with optogenetic mice to control the activity of interneurons in vivo. In vivo recordings of the activity of interneurons shows significant resetting of ongoing cerebral rhythm at the onset of laser light pulses. Trains of periodic laser pulses with a frequency of 40 Hz and variable duty cycles were used. There are qualitative differences between the power distribution over different frequency bands between the control and the mice treated with cocaine or various dopamine antagonists. We were able to use delay embedding method to reconstruct a stable three-dimensional attractor of the neural activity.

## TRANSLOCATION MUTANTS IN LEUCYL-tRNA SYNTHETASE RESULT IN INTRACELLULAR TOXICITY FOR E. COLI

Daniel McDonough and Rachel Whitaker  
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Each of the aminoacyl-tRNA synthetases (aaRSs) selectively activate and aminoacylate just one of the twenty standard amino acids to its cognate tRNA. These enzymes ensure fidelity by employing a double sieve model. Essentially, the aminoacylation site in the canonical core of the aaRS acts as a coarse sieve that excludes most amino acids, but does bind structurally similar amino acids. A second hydrolytic active site serves as a fine sieve that blocks the correctly charged amino acid and clears mischarged amino acids. At least half of the aaRSs rely on an amino acid editing mechanism to facilitate incorporation of the correctly charged amino acid-tRNA complex during protein synthesis. The hydrolytic site typically lies within a separate editing domain. In LeuRS, and the homologous IleRS and ValRS, the editing active site is located within the CP1 domain. In LeuRS, a translocation event is required to move the charged products formed in the aminoacylation active site approximately 30 Å to the hydrolytic active site. The mechanism by which this occurs is poorly understood. We have introduced a series of mutations that appear to specifically affect translocation. These translocation mutants exhibit high

mischarging of noncognate amino acids to tRNA<sup>Leu</sup>, but significantly, the hydrolysis activity of mischarged tRNAs remained unaffected. We combined these mutants with a T252A mutation, which uncouples specificity and efficiently hydrolyzes Leu-tRNA<sup>Leu</sup>. Leucylation activity of the T252A mutation was rescued, supporting our hypothesis that these mutations impede translocation between the aminoacylation and editing active sites. By rendering the translocation event defunct, the enzyme is prone to make mistakes and thus become toxic to the cells. We believe by targeting this area with an inhibitor that we may selectively stop the growth of *E. coli* cells.

#### INHIBITION OF INSULIN-LIKE GROWTH FACTOR SIGNALING IN A SMALL CELL LUNG CANCER CELL LINE

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Small Cell Lung Cancer (SCLC) is the most aggressive and lethal subtype of lung cancer. The Insulin-Like Growth Factor I (IGF-1) pathway plays an important role in SCLC. We investigated the potential of targeting the IGF-1 receptor, (IGF-1R) and mammalian target of rapamycin (mTOR), a kinase that is activated by the PI3/Akt pathway, as a potential therapeutic strategy against SCLC. H526, a SCLC cell line was used to monitor cell growth and cell signaling activity after the treatment of the cells with well-known inhibitors. The drugs used were NVP-ADW 742 (NVP), an inhibitor of the kinase domain of IGF-1R, and RAD001 (Everolimus, EVE), an inhibitor of mTOR, which is used in anti cancer treatments in advanced renal cell carcinoma and other malignancies. NVP is shown to inhibit cell growth and increase apoptotic activity in certain SCLC cell lines while inhibition of mTOR by RAD001 has been shown to induce apoptosis. Experimental evidence show that RAD001 induced apoptosis is prevented by IGF-1. A combination of IGF-1R and mTOR inhibition is a strategy that we are undertaking to be tested in order to restore induction of apoptosis in malignant cells. To establish optimal inhibitor concentrations, MTT cell growth assays were performed with various concentrations of the drugs individually. From preliminary experimental results we show that the most effective inhibition of H526 cell growth was at 1 $\mu$ M NVP-ADW 742 and 10nM EVE. Concentrations higher than these were toxic to the cells. Currently Western Analysis is being carried out to monitor the by-products of the apoptotic process after treatment of the cells with 1 $\mu$ M NVP-ADW 742 and 10nM EVE to determine if apoptosis is induced by the treatments.

#### THE HUNT FOR A METHOD TO PREDICT PREGNANCY OUTCOME BASED ON SPERMATOZOAL PARAMETERS – A CONTINUING SAGA

LT Motes<sup>1</sup>, H Qiao<sup>2</sup>, HL Higdon III<sup>2</sup>, WC Bridges, Jr.<sup>2</sup>, JD Shultz<sup>3</sup>, and WR Boone<sup>3</sup>

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We continue to look for variables in semen specimens that may act as discriminators to give us a method to predict pregnancy in couples seeking fertility treatments. From a database of 127 semen samples taken from a university-based hospital infertility practice, we examined various sperm kinematic to determine their correlation to predicting pregnancy. The three main kinematics were average path velocity, straight line velocity, and curvilinear. We used several methods to determine if a relationship existed for kinematics and pregnancy. The first method attempted to identify simple kinematic values obtained following sperm separation via passing the semen specimen through a gradient. This method failed to identify any kinematic that was highly predictive of a positive clinical pregnancy when intrauterine insemination was used with the post-gradient specimen. The second method used a statistical approach. A linear model was defined for the probability of pregnancy as a function of the variables and Stepwise Logistic Regression Variable Selection was used to determine the variables that had statistically significant contributions to the model, but this model only yielded 4% accuracy for predicting a pregnancy. The third method was also a statistical approach. Data mining techniques were used to split values of the sperm characteristic variables into low and high, and then determine the right combination that would result in a decision tree for pregnancy outcome. This method yielded 48% accuracy in predicting which patients would become pregnant after intrauterine insemination with the specific spermatozoal specimen. We continue to investigate methods to develop an even better prediction function, possibly using a combination of the aforementioned methods.

#### COLLOIDAL QUANTUM DOT SENSORS FOR THE DETECTION OF UNUSUAL DNA STRUCTURES ASSOCIATED WITH HUMAN DISEASES.

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Novel methods for the detection of DNA are highly desirable for genetic defect detection. Many, if not most, diseases have their roots in our genes. More than 4,000 diseases are thought to stem from mutated genes inherited from one's mother and/or father. Human neurodegenerative diseases such as Fragile X syndrome, Huntington's disease, Myotonic Dystrophy, and Alzheimer Disease, to name a few, has been traced to genetic mutations. Everything interesting, either useful or harmful, that occurs with DNA, occurs when DNA changes from the normal regular B-form. Our work is focused on developing inorganic nanomaterials as optical probes of human neurodegenerative disease related non-B DNA conformations, and, on studying how modifications of the surfaces of these nanomaterials affect their functionality for sensing sequence directed DNA structures. Long-term potential applications of this research at the DNA-nanomaterial interface include the development of nanoparticles as optical DNA diagnostics, nanoparticle DNA delivery agents, and a more thorough understanding of the operating parameters for DNA-based nanodevices.

## EFFECTS OF TAMOXIFEN, BENZO-A-PYRENE, AND POLYCYCLIC AROMATIC HYDROCARBONS ON GALECTIN-3 EXPRESSION IN HUMAN BREAST CANCER

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Galectin-3 plays an important role in a number of disease processes including cancer. Concentration of galectin-3 increases in the bloodstream of patients with cancer, and galectin-3 also plays an important role in preventing cellular apoptosis. Cancer researchers have shown that galectin-3 is upregulated in cancer patients. The effects of Tamoxifen (TAM), Polycyclic Aromatic Hydrocarbons (PAHs) and Benzo-A-Pyrene (BAP) have been studied on breast cancer cells. Tamoxifen has been shown to have anti estrogenic effect by blocking estrogen receptors. It has been used to treat cancer patients, while Polycyclic Aromatic Hydrocarbons and Benzo-A-Pyrene are known as environmental pollutants and possible carcinogens. Moreover some PAHs have estrogenic effect. MDA-MB-231 human breast cancer cells were grown in 35mm dishes and maintained in RPMI 1640 medium containing 10% fetal bovine serum and 5% penicillin. When these cells were 90% confluent, they were exposed for 24 hours to Tamoxifen (5µg/ml and 500ng/ml), BAP (5µg/ml and 500ng/ml), or PAHs (5µg/ml and 500ng/ml). Protein was extracted by M-PER protein extraction reagent and quantified by the protein assay kit using BSA as standard. Proteins were separated by SDS-PAGE and subjected to western blot analysis. Immunodetection was carried out by using rabbit polyclonal galectin-3 primary antibody followed by incubation in goat anti-rabbit secondary antibody. After chemiluminescence detection, the proteins were visualized on X-ray film. The data showed that levels of galectin-3 were significantly low with the high doses of TAM, BAP and PAHs.

## DESIGN AND SYNTHESIS OF DUAL ACTIVE DERIVATIVES OF NOVEL ANTIBIOTIC CYTOSPORONE E

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As the emergence of more drug-resistant strains of microorganisms portends global crisis, the development of novel antibiotic agents becomes crucial. The new antibiotic cytosporone E originates from the fungus *Cytospora sp.* and demonstrates weak antibiotic activity. The purpose of this study is to synthesize and analyze the derivatives of cytosporone E for cytotoxicity. The derivatives share the same phthalide chromophore with a 4-position hydroxyl group determined to be necessary for activity. In synthesis of the analogs, we utilized an electrophilic aromatic substitution followed by Fischer esterification to generate 5,6-dimethoxy phthalide from 3,4-dimethoxybenzoic acid. The phthalide will be alkylated to afford a common intermediate that will be used to incorporate secondary antibiotic characteristics: a triazole moiety or a citric acid silver or gold ion chelator (both have been shown effective in other antibiotics). These novel and potentially more potent antibiotics hold promise for treatment of the continually increasing drug-resistant bacterial strains.

## FAST FOOD VERSUS SLOW FOOD: WHAT STUDENTS EAT WHEN THEY HAVE NO TIME

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Most college students need food that can be eaten quickly in order for them to return on time to their next class or place of work. The quickest option they can think of is fast food. Fast food includes food that is meant to be prepared and eaten quickly. This includes foods from fast food restaurants and frozen prepared foods. There is a healthy alternative to fast food, and that is slow food. The term "slow food" includes food that is fresh, non-frozen, locally grown, and in season. With students crunched for time, is there really time for slow food? With the convenience of fast food, the topic of slow food has been greatly overshadowed. There are many students who have never even heard of the term "slow food." With time limitations that college students face, unless there is someone to prepare the food, slow food does not even become a viable option when compared to fast food. The study was therefore conducted to gather information on students' knowledge and consumption of fast and slow food so preventive education and information on healthy eating habits can be developed and disseminated. A convenience sample of 100 college students attending the USC Sumter was obtained. The 30- item question survey was constructed, beta-tested and distributed among 100 students. Participation was voluntary with no identifiers from the participants. The survey included domains on demographics, regularity of fast food consumption, preferred fast food establishments, knowledge of slow food and interest in knowing about slow food. Of the 100 students surveyed, 45% were male and 55% were female. The majority ranged in age from 18-24. Eighty-seven percent enjoyed eating fast food and 12% supersized their food if given the option. French fries were the most popular item to supersize. While none of the students thought fast food was completely healthy, 15% were concerned about the health risks associated with fast food. Eighty-five percent of the students followed a non-vegetarian diet as their lifetime diet. Twenty-two percent of the students cooked their own meals, whereas 74% had either a family member who cooked, or cooked along with the family member. However, 4% reported that they did not cook nor had family members who cooked meals and therefore turned to fast food as an option. While 55% showed interest in slow food, 45% were either unsure or showed no interest. Our results indicate that students need to have information and education on slow food and healthy eating habits to enhance their physical and emotional wellbeing, and enjoy the benefits of increased longevity and quality of life. The small sample size and convenience sampling are the limitations of the study. Future work will focus on an increased sample size and developing educational materials on the benefits of slow food.

## INHIBITION OF THE MTOR/PI3K PATHWAYS TO ENHANCE SENSITIVITY OF OVARIAN CANCER CELLS TO CHEMOTHERAPY TREATMENT

Lindy Pence, Zachary Dobbin, Adam Steg, Ashwini Katre, and Charles Landen  
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The American Cancer Society estimated for 2012 that 15,500 women in the United States would lose their lives to ovarian cancer. In addition, the 5-year survival rate for ovarian cancer is a disheartening 46%. This low rate is the result of ovarian cancer being frequently diagnosed at advanced stage, and having a high rate of recurrence and development of chemoresistance. To improve survival in ovarian cancer, many biologic therapies have been developed, but have shown disappointing results when used alone. Therefore this study investigates whether biologic pathways can be targeted in combination with chemotherapy in order to kill the resistant population that survives after primary therapy. The mTOR and PI3K pathways have been recognized as being frequently overactive in ovarian cancer cells, and these two pathways have been targeted individually with inhibitors. However, the redundancy and crosstalk between these pathways have limited the success of single-target inhibitors. Recently, inhibitors have been developed that concurrently target both mTOR and PI3K, potentially eliminating this feedback loop.

In this study one such inhibitor, PF-04691502, was tested on both chemoresistant and chemosensitive ovarian cancer cell lines for decreasing cell viability with and without the presence of chemotherapy agents paclitaxol and carboplatin. The chemosensitive cell lines are highly sensitive to the dual inhibitor, but no synergy was seen when combined with chemotherapy. Chemoresistant lines are less sensitive to PF-04691502 alone. Thus far PF-04691502 appears to be a promising agent in chemosensitive ovarian cancer, but only shows additive effects on chemoresistant cell lines.

## CLONING AND TESTING A DNA-TRANSPOSON BASED GENE DELIVERY SYSTEM

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HIV-1 is a retrovirus that infects CD4+ T helper cell causing the gradual deterioration of immune function. AIDS is the end stage of this virus infection and characterized by a T helper cell count of less than 200 cells per microliter and one or more opportunistic infections. Current treatments use antiviral drugs to greatly reduce viral load; however, there are no current treatments that completely eliminate virus from the body. Anti-HIV gene therapy is a promising area of study that would deliver therapeutic genes as a way to “immunize” susceptible cells. This project investigates the use of the *Sleeping Beauty* (SB) DNA transposon-based delivery system. Transposons are non-viral, and are being investigated as a viable option to viral vectors. In comparison, the SB transposon has reduced immunogenicity, improved safety and toxicity, and low promoter and enhancer activity. Our initial studies have been to develop and clone a reporter construct into the SB plasmid vector. We are currently carrying out studies to map SP insertion sites in transfected cells.

## IDENTIFYING IN-STREAM FLOW REQUIREMENTS & ECOLOGICAL DRIVERS FOR HYDROPOWER PROJECTS IN THE ACF (APALACHICOLA, CHATTAHOOCHEE, FLINT) RIVER BASIN

Evan Robinson  
Morris College

In-stream flow is the amount of water running through a stream at a particular time. Flows in a river need to be at a specific level at a specific time in order to adequately provide a sustainable ecosystem for many different species of animals. River dam construction alters the ecological balances and natural flows in the river. Federal organizations regulate incoming and outgoing flows by setting for each dam site a flow requirement. In-stream flow is becoming a growing issue when it comes to dam construction because it is becoming harder to balance all of the needs for the project and the environment around the site. After using Hydro GIS, ARC map and other licenses, databases, and journals, we found that drought endangered animals around and in the dam site, and incoming flows from peaking projects up-stream proved to be the major deciding factors in regulating flows in the ACF (Apalachicola, Chattahoochee, Flint) river basin. Important information and some fields from NID (National Inventory of Dams) spreadsheets were used as surrogates to help pin-point specific causes for the flow requirements along the projects in the river. The most important fields were used in ARC map to visualize these problems in layers on a base map of the ACF basin.

## ATMOSPHERIC GRAVITY WAVES

Brian Rogers  
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Much research has been conducted, especially in the past decade, to try and understand the phenomenon known as atmospheric gravity waves. These waves can be emitted from wind passing over mountains, thunderstorms, wind shear in jet streams, or from solar radiation. All gravity waves share similar properties such as, having wave characteristics like wavelength and frequency and have two restoring forces: gravity and buoyancy. These waves can propagate into different levels of the atmosphere allowing the levels to mix slightly and can have major effects on weather and ultimately climate. Knowing the wave characteristics and how they interact with the atmosphere can lead to a substantial improvement to our understanding of the atmosphere.

The studied waves were found by looking at wind divergences over open ocean settings, typically located around storms. Using a weather research and forecasting model (WRF), the storms were projected into the future from their origin. The relative

strength of the storms was determined using a calculation known as frontogenesis. Atmospheric gravity waves that were produced were then analyzed using a fast fourier transform to determine their wave characteristics. These open ocean cases were then analyzed to determine whether or not there was any correlation with the frontogenesis of the storms and the characteristics of the atmospheric gravity waves that they produced.

#### SOLVENT-FREE PERACETYLTATION OF CARBOHYDRATES

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Peracetylated carbohydrates are important and useful intermediates in carbohydrate chemistry, especially for chemical glycosylations. Classic peracetylation of carbohydrates requires pyridine as the solvent (as well as a base) to promote the acylation process. However, pyridine is toxic and unpleasant and often complicates the reaction workup and product purification. For this reason, we introduce a solvent-free approach for the preparation of peracetylated carbohydrates promoted by 4Å molecular sieves. Several examples of carbohydrate and non-carbohydrate substrates are provided to demonstrate the scope of this method.

#### A MISERE NIM GAME

Ibrahima Seck

USC Salkehatchie

In 1902, C. Bouton provided the mathematical theory of the Nim game, and discussed the misere version of the standard Nim game. In this project, we use the similar method used in the normal-play Nim game to develop a winning strategy for the misere Nim game. The generalization of three player version is also discussed.

#### PURIFICATION OF QUANTUM DOTS BY GEL PERMEATION CHROMATOGRAPHY

Yi Shen, Megan Y. Gee, Rui Tan, Perry J. Pellechia, and Andrew B. Greytak

Department of Chemistry and Biochemistry, USC Columbia

Synthesis of quantum dots (QDs) requires a large amount of ligands to improve the stability at high temperature. However, for further application and surface modification of QDs, excess ligands must be removed. The traditional precipitation/redissolution process cannot provide highly repeatable results due to: (1) variability in precipitation condition necessary for different QD batches (2) some impurities have similar solubility properties as the QDs. In this talk, I will describe using gel permeation chromatography (GPC) as a method to purify different types of QDs, including CdSe and CdSe/Cd<sub>x</sub>Zn<sub>1-x</sub>S QDs. <sup>1</sup>H NMR and thermo gravimetric analysis (TGA) have been used to compare the nature and quantities of ligands adsorbed on the QDs after different purification methods. The preparation of highly purified QDs allows us to revisit the influence of impurities and excess ligands on further chemical reactions at the QD surface. Here, inorganic shell growth and ligand exchange have been investigated as representative samples. Surface elemental enrichment of well-purified CdSe QDs has also been studied based on <sup>1</sup>H NMR, <sup>31</sup>P NMR and Inductively coupled plasma mass spectrometry (ICP-MS). The results have been compared to those obtained by the traditional surface analysis technique X-ray photoelectron spectroscopy (XPS).

#### A STUDY OF THE ROLE OF GBA (B-GLUCOCEREBROSIDASE) EXPRESSION IN CERAMIDE INCREASE DURING CELLULAR SENESCENCE

Ashton Shultz, Joshua Muccitelli and Virginia Probin

Charleston Southern University

Cellular senescence is defined as a permanent loss of the proliferative ability of a cell after extensive divisions either *in vivo* or *in vitro*. Senescence has often been referred to as cellular aging and is a hot topic in the field of organismal aging as well as cancer therapy. As such, pursuing the mechanisms of cellular senescence is a worthwhile endeavor for the field of aging research. The role of ceramide metabolism in cellular senescence is a new and exciting chapter in senescence research. Our lab has previously shown that an increase in ceramide during fibroblast senescence is due to changes in expression of the enzymes involved in ceramide recycling, specifically a decrease in sphingosine kinase 1 (SK1) expression. This study seeks to evaluate the role that glucosylceramide recycling may play in ceramide increase. Our preliminary data shows an increase in GBA expression and a decrease in glucosylceramide levels in senescent WI38 fibroblasts. This suggests that recycling of glucosylceramides may contribute to the increase in ceramides seen during cellular aging, thereby elucidating a new pathway of ceramide metabolism manipulation during cellular senescence.

#### COMPARATIVE STUDY OF HIV-1 INDUCED APOPTOSIS BY EXPRESSION OF PRO-APOPTOTIC BAX AND TBID

Priscilla S. Simon, Claudia A. Fulmer, and William H. Jackson

Department of Biology and Geology, USC Aiken

The Human Immunodeficiency Virus type 1 (HIV-1) is a lentivirus in the family *Retroviridae* that infects CD4<sup>+</sup> T-Helper (T<sub>H</sub>) lymphocytes. Long-term HIV infection is associated with the loss of the T<sub>H</sub> lymphocyte population, progressive impairment of

the immune response, and AIDS. We are currently investigating the inhibition of viral replication in HIV-1 infected cells through induction of pro-apoptotic gene expression. This strategy takes advantage of a distinctive characteristic of HIV-1 infected cells, which is based on the activity of the viral transactivator of transcription (tat). Tat binds to the viral transactivation response element (TAR), located within the first sixty nucleotides of all viral mRNAs, and recruits a number of host factors that act to hyperphosphorylate the C-terminal domain of RNA Polymerase II, which results in increased processivity and efficient transcription from the viral promoter/enhancer. We have created a number of plasmids containing an expression cassette that is controlled by the HIV-1 promoter and enhancer, and that are therefore, Tat dependent. Studies in 293T cells, co-transfected with pU3ReGFP and pCMV-Tat, indicated that GFP was expressed in a tat-dependent manner. To determine the ability of the pU3R plasmid to drive expression of pro-apoptotic genes, the eGFP sequence was replaced with either tBid or Bax, which are members of the Bcl-2 family and occur naturally in eukaryotic cells. Studies thus far have shown that tBid is more toxic to cells in the presence of Tat. Studies are underway to determine the ability of each pU3R plasmid to initiate apoptosis in a tat-dependent manner, and their effect on cells in the absence of tat.

#### THE ANALYSIS OF AN EPIGENETIC MODIFICATION IN AMERICAN ALLIGATORS ORIGINATING FROM CONTAMINATED AND REFERENCE ENVIRONMENTS

Aposia Singleton  
Morris College

Endocrine disrupting contaminants (EDCs) affect the reproductive and endocrine systems of wildlife and humans. Animals living in contaminated environments show decreased rates of fertility, hatchability, and impaired hormone secretion. In the present study, three sites were used to compare the relationship of EDCs contamination levels to DNA methylation in the American alligator. Lake Apopka is an environment characterized by EDC contamination, whereas Lake Woodruff is a national wildlife refuge, which is relatively pristine, and Yawkey, an uncharacterized site. Research has shown that expression of genes involved in hormone signaling is altered in alligators (*Alligator mississippiensis*) living in Apopka. These perturbations have been shown to persist well past exposure, thus implying an underlying epigenetic mechanism. DNA methylation is the most fundamental and best studied epigenetic modification to date. In order to detect total DNA methylation in the entire genome, we measured the proportion of 5-methyl-2 deoxycytidine (5mdc) of total cytosine using liquid chromatography / tandem mass spectrometry. Genomic DNA extracted from ovarian tissue from animals originating from Lake Apopka showed an increased proportion of DNA methylation compared to animals in a relatively pristine site, Lake Woodruff. However, statistical analysis showed that these differences were not significant. Further studies analyzing DNA methylation in more animals and in other tissues are needed to better characterize the genomic methylation status of these animals.

#### EXPLORING THE MECHANISMS OF ALLELOPATHIC INTERACTIONS IN THE INVASIVE ANNUAL PLANT, *PHYLLANTHUS URINARIA*.

Alyssa Smith and Andy Dyer  
Department of Biology & Geology, USC Aiken

The belowground mechanisms facilitating invasion and proliferation of non-native plant species into natural communities are ecological concerns critical for the understanding of plant invasion. While the concept of allelopathy suggests that some exotic plant species produce compounds via root exudates that may suppress or inhibit the growth of neighboring plants, understanding the specific mechanisms and consequences of these plant-chemical interactions remains elusive. In an effort to understand the abiotic and biotic factors governing allelopathic activity, a greenhouse-controlled experiment using multiple soil treatments was developed to examine the legacy effects of the presence of a non-native species, *Phyllanthus urinaria*, on the biomass of target species, *Brassica rapa*. The target species was grown without competition in the soil previously occupied by the non-native species. Results confirmed that the legacy effect of the non-native negatively influenced growth of the target species and this effect was proportional to biomass of the non-native grown in the soil. However, it is unclear whether the mechanism responsible for this negative effect is associated with chemical suppression (i.e., allelopathy) or with depletion of soil nutrients. Soil analysis for phyto-toxic compounds, such as organic acids, may provide useful insight into understanding the factors that enable alien species to be successful invaders of natural communities.

#### BIOLOGICAL IMPLICATIONS OF DNA GLYCATION IN PROSTATE CANCER DISPARITIES

Danzell M. Smith<sup>1</sup>, John S. Hepburn<sup>1</sup>, Judith D. Salley<sup>1</sup>, Mhatabuddin Ahmed<sup>1</sup>,  
David Turner<sup>2</sup>, Marvella E. Ford<sup>2</sup>, and Dennis Watson<sup>2</sup>

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Prostate cancer is one of the leading causes of death among men. When broken down by race there is a major disparity between African Americans and European Americans. African Americans are more likely to be diagnosed, develop more highly aggressive forms, and have higher mortality rates when compared to other races. The high levels of sugars and starches in the diets are strong contributing factors to the higher amounts of blood sugar which cause high levels of AGEs to be formed. Carboxymethyl-2'-deoxyadenosine (CMdA) is the AGE that was targeted. A methodology involving 2'-deoxyadenosine and chloroacetic acid has now been achieved paving the way for successful synthesis of CMdA and its radiolabelled derivative. Synthesized standards, LC/MS, MS-MS spectroscopy will be used to examine the levels of CMdA



present in enzymatically hydrolyzed DNA samples from African American, and European American prostate tissue samples available. These results may provide an explanation for the racially biased cancer disparities observed.

#### PRODUCTION AND CHARACTERIZATION OF FLEXIBLE AND RIGID POLYURETHANE FOAMS USING BIO-BASED SURFACTANTS

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Surfactants are applied during the mixing stages of polyurethane foam production. Typically in chemical industry, surfactants are derived from petroleum-based polyols, however, in this research project, natural, bio-based polyols are the precursor to the surfactants. The main focus of the research project is to synthesize a series of molecules utilizing the bio-based poly functional alcohols and siloxanes to produce surfactants that will have surface-active properties needed to improve the production of polyurethane foam synthesis based on polyol esters. There are three stages of synthesis to form the bio-based surfactant and these include an allylation of a bio-based polyol, formation of a silica hydride co-polymer, and a coupling reaction with the allyl substituted polyol and silica hydride, yielding the desired surfactant. Several surfactants have been synthesized and the surface-active properties are currently being tested.

#### AN AGGREGATE INFORMATION CONTENT BASED METHOD TO MEASURE THE SEMANTIC SIMILARITY OF GO TERMS

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The rapid development of Gene Ontology (GO) and huge amount of biomedical data annotated by GO terms necessitate computation of semantic similarity of GO terms and, in turn, measurement of functional similarity of genes based on their annotations. This paper proposes a novel and efficient method to measure the semantic similarity of GO terms. This method addresses the limitations in existing GO term similarity measurement methods by using the information content of all ancestor terms of a GO term to determine the GO term's semantic content. The aggregate information content of all ancestor terms of a GO term implicitly reflects the GO term's location in the GO graph and also represents how human beings use this GO term and all its ancestor terms to annotate genes. We show that semantic similarity of GO terms obtained by our method closely matches the human perception. Extensive experimental studies show that this novel method outperforms all existing methods in terms of the correlation with gene expression data.

#### CYBER-PHYSICAL ARCHITECTURE, CLOUD COMPUTING AND MOBILITY: THE VERTICAL DESIGN OF A SENSOR-BASED, MICROCONTROLLER SYSTEM INCORPORATING PREDICTIVE ANALYTICS

William Southgate, William Binnicker, and Chris Starr  
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Cyberphysical computing is enabled by lowpower, inexpensive sensors and processors. This paper reports on the results of defining the computing architecture that exploits a sensorbase microcontroller architecture in a distributed fashion in the physical environment in the sustainability sector. In addition, a project implementation of the architecture is presented. The aim of the research was to solve two common problems. First, how to make more efficient the collection of distributed recycling within a city or organization. Second, how to quantify recycling programs at a finer level of granularity. The solution developed to rectify these issues took the form of the College Digitally Assisted Recycling (CDAR) project. At the core of this is the Arduino singleboard microcontroller. Coupled with an ultrasonic distance sensor attachment, the Arduino can detect and measure distances between two and fortyfive centimeters. Using this the capacity of recycling bins can be determined by measuring the space between the sensor and the refuse. The shorter the distance, the fuller it is. By attaching an Arduino to each recycling bin within a distributed network of several and using readings obtained from CDAR software, written in Java, an accurate ( $\pm 1$  cm) measurement of bin capacity could be obtained. This data could then be passed along to the organization in charge of recycling to notify them when the bins were predicted to be full and ready to be emptied. From these measurements, along with predictive analytics, it could be determined when next the network of bins were thought to be full. Thus, a more efficient recycling schedule can be devised, as well as allow for a new level of precision in measuring recycling at a much finer granularity than is normally taken into account.

#### THE VASCULAR FLORA OF BROOKHAVEN NATIONAL LABORATORY, LONG ISLAND, NEW YORK.

R. Stalter and E. E. Lamont, Bashir Y., Henriques V., Keitt T., Lamare N., Nwajei C., Nafaset A., Rabb S., Rencher N., Shehzadi S., Yousef R., Ara W., Reed J. and Przemielewska A. Garcia Angus, A.  
St. John's University

The objective of this study was to collect and document the vascular plant species at 2,236 hectare Brookhaven National Laboratory. Collecting trips were made to the laboratory at two week intervals beginning in April, 2007, terminating on October, 2009. Three hundred twenty nine species in 231 genera in 95 families have been identified. The Asteraceae (42 species) and Cyperaceae (24 species) were the largest families in the flora. The largest genera were Carex and Quercus each with 7 species. Ninety eight species, 30% of the flora were not native to the region. Over 500 voucher specimens were collected.

## THE HUBBLE EXOPLANET CLASSROOM

Laura Stevens<sup>1</sup>, Joseph Carson<sup>1</sup>, Kat Low<sup>1</sup>, Starr Jordan<sup>1</sup>, David Ruwadi II<sup>1</sup>, Starr Jordan<sup>2</sup>, and Glenn Schneider<sup>3</sup>

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I present a status report on the Hubble Exoplanet Classroom, an interactive website designed to engage 8-12th grade students in physical science concepts using the exciting field of exoplanet studies. Addressing national teaching standards, the webpage allows educators to enhance their physical science, physics, and astronomy curriculum with student-driven lessons. The webpage records students' performance in lessons and quizzes and compiles the results, which can be accessed by the instructor using a secure website.

## ANTI-HIV VIF ACTIVITY USING A HAMMERHEAD RIBOZYME EXPRESSED FROM AN RNA POLYMERASE III PROMOTER

Madison T. Sweet, Alexander S. Jureka, and William H. Jackson

Department of Biology and Geology, USC Aiken

APOBEC3G is an anti-retroviral host protein that causes hyper-mutation of retroviral DNA during reverse transcription, thereby terminating the viral lifecycle. HIV encodes the virion infectivity factor (Vif), which degrades APOBEC3G and allows HIV to replicate unimpeded. Hammerhead ribozymes are small catalytic RNAs that contain a conserved catalytic core and cleave target mRNA's in a sequence specific manner. We have designed and cloned hammerhead ribozymes against three sites within the HIV-1 NL43 Vif sequence (accession number M19221). Each ribozyme was cloned into the retroviral vector, p.Super.retro.puro (pSRP), forming a library of reagents: pSRPVif 5113, pSRPVif 5127, and pSRPVif 5154. Similarly, we have cloned a non-catalytic version of each: pSRPVif 5113NC, pSRPVif 5127NC, and pSRPVif 5154NC. To test the anti-Vif activity of these ribozymes, 293T cells were co-transfected with two micrograms pNL43.Luc.R-E-, an HIV-1 genomic clone, and four micrograms of either a catalytic or non-catalytic ribozyme. Reverse Transcriptase PCR of the resulting cellular RNAs suggests that Vif 5113 and Vif 5154 reduce Vif RNA expression as compared to the control.

## STUDY OF SHELL GROWTH MECHANISM FOR CDSE/CDS CORE/SHELL QUANTUM DOTS BY SILAR METHOD

Rui Tan, Douglas A. Blom, Shuguo Ma, and Andrew B. Greytak

Department of Chemistry and Biochemistry, USC Columbia

Colloidal quantum dots (QDs) are a type of semiconductor nanocrystal (NCs) with exceptional spectroscopic properties such as high photoluminescence quantum yield, high photo-stability versus organic fluorophores, large extinction coefficients for light harvesting, and size-tunable emission wavelength across visible and mid-infrared. In order to adjust the photo-physical properties of QDs, QD core-shell heterostructures have been introduced and widely explored. Both isotropic and anisotropic core-shell structures have attractive properties that can lead to advantages in different applications. Selective ionic layer adhesion and reaction (SILAR) is a technique for shell growth in which precursors bearing each of the elements necessary for the desired binary compound are added separately, in alternating steps. The goal of the technique is to enforce isotropic growth and suppress nucleation of new particles of the shell compound. While the SILAR method is widely employed for growth of core/shell QDs, it is unclear whether alternating addition of stoichiometry doses can be effective or not. This makes it difficult to rationally apply SILAR as technique for formation of shells on high-dimensional nanostructures.

We monitor effective bandgap energy shifts (by UV-vis absorption and photoluminescence spectra) and free reagent concentration (by inductively coupled plasma mass spectrometry (ICP-MS)) during the formation of CdS shells on CdSe nanocrystals to test the essential hypothesis of the SILAR shell growth method: that alternating addition of stoichiometric doses of precursors can effectively saturate surface sites and thereby enforce conformal shell growth. The strong redshift that takes place when CdS shells are grown on CdSe cores provides a convenient process monitoring tool that complements Scanning Transmission Electron Microscopy (STEM) imaging and analytical measurements of free reagent concentration. We find that under commonly-used conditions, 1) the shell growth starts from CdSe cores with neutral surfaces, 2) a Cd(oleate)<sub>2</sub> precursor reacts incompletely at CdSe core surfaces, with the reaction reaching an equilibrium between Cd bound to the core surface and remaining in solution. Although approximately spherical particles are obtained, the growth does not proceed via saturating cycles as described in the SILAR mechanism. With this understanding, we were able to employ sub-monolayer dose to obtain increased synthetic yield and suppress nucleation of shell material. Our results illustrate potential challenges in employing SILAR for the rational control of conformal and/or regioselective growth of epilayers on nanocrystal quantum dots and higher-dimensional chalcogenide semiconductor nanostructures.

## PREPARATION OF CURCUMINS FROM ACETYLACETONE TRIANION AND SELECT COUMARIN ESTERS, ALDEHYDES, AND KETONES

Alton R. Thomas, Clyde R. Metz, and Charles F. Beam

Department of Chemistry and Biochemistry, College of Charleston

Acetylacetone can be activated to form its 1,3,5-trianion by treatment with sodium hydride and *n*-butyllithium or excess lithium diisopropylamide (LDA). This intermediate can undergo twofold aldol-type condensation with select aldehydes or ketones to yield curcumin  $\beta$ -diketones through condensation-elimination by reaction with substituted benzaldehydes, or in

the case of ketones such as benzophenone to afford 1,7-dihydroxyheptanediones in unanticipated high yield. These dihydroxyheptanediones underwent cyclodehydration with cold, concentrated sulfuric acid to afford substituted 2,3-dihydro-4H-pyranones [ e.g., 6-(2,2-diphenylethenyl)-2,3-dihydro-2,2-diphenyl-4H-pyran-4-one]. Twofold linear dehydration was achieved with glacial acetic acid, forming tetraphenylheptadienediones. All targeted products are curcumin analogs, with each having potential for biological activity. Evaluation for activity is planned to be conducted at the Medical University of South Carolina

#### SEARCHING FOR PROPHYLACTIC BACTERIOPHAGES THAT INFECT AND LYSE *STAPHYLOCOCCUS AUREUS* OR *ESCHERCHIA COLI*.

Ina Troutman, Jordan Wesel, and Dr Paul E. Richardson  
Dept. of Biochemistry, Coastal Carolina University

Bacteriophages (phages) are absolute parasites that solely infect and lyse bacteria. They are one of the most abundant entities on Earth and carry all the information needed to direct their own reproduction once introduced into a host cell. Before the discovery of antibiotics, phages were used as prophylactic and therapeutic agents against bacterial infections. Since the commencement of antibiotics and their widespread use in fighting bacterial infections, there has been an emergence of bacterial organisms that have developed resistance. This has led to an inevitable augmentation in antibiotic production, which is both expensive and time consuming.

Phages, however, can simultaneously mutate with the bacteria, providing an alternative to fighting of these evolving strains of bacteria. This concept is imperative due to the rapid evolution of bacteria and the unequivocal progression of antibiotics. This research could provide significant progressions in the treatment and prevention of infectious diseases through the bacteriolytic actions of phages. Not only will this research impact the innovation of medicine and the health of the society, but it will also improve agricultural settings and the safety of food production. The purpose of this research is to search for naturally occurring phages that could potentially be used as natural therapeutic agents with the ability to inhibit infectious diseases.

#### POPULATION DYNAMICS OF THE INVASIVE *D. LUMHOLTZI* IN LAKE WATEREE, SC

Daniel Truncellito, Jeff Steinmetz, Ann Stoeckmann, John Ludlam, and Derek Turner  
Biology Department, Francis Marion University

*D. lumholtzi* is a species of zooplankton that is found in Africa, Australia and southwestern Asia. Its first appearance in the United States was in Texas in 1990. Since that first occurrence, it has been found in 152 major bodies of water and most have been found in the central/southeastern U.S. This species of *Daphnia* has a long spine coming off the top of its head, which makes it less attractive to predators (mainly fish). For this reason, *D. Lumholtzi* has the potential to out-compete the native *Daphnia* species. Previous studies have shown that *D. lumholtzi* populations do not compete with native species due to temporal niche partitioning. Previous studies found that native species tend to peak early in the summer, while *D. lumholtzi* tends to be greatest during the late summer.

In our study, we sampled Lake Wateree every month from May until August. Then, we sampled quarterly over the winter and then every two weeks again the following May and June. Twelve zooplankton samples were taken during each sampling date. Water quality samples were taken at four of the twelve sampling locations. We found that there was no significant impact of *D. lumholtzi* on the population of the native *D. parvula* and there was no temporal niche partitioning which was different from previous findings. We found that there was a strong positive correlation between *D. lumholtzi* and *D. parvula* (p-value: 0.0014), indicating a lack of competition between the two species.

#### HOW TO RESET THE PHASE OF A NEURON

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Nervous systems are composed of complex networks of neurons, which are chemical and electrical signal lines. Central Pattern Generators (CPGs) are autonomous networks of neurons that send signals within the brain and to muscles controlling repetitive bodily actions such as walking and breathing. Although each CPG is a complex system, its component neurons can be modeled as intrinsic bursters (pacemakers) that fire at regular intervals. When an intrinsic burster receives signals, or inputs, from other neurons in the CPG network, it converts these signals into measurable changes of its firing rate and passes this output to the next neuron.

We investigated how the input-output relationship of individual intrinsic bursters, i.e., the phase resetting curve (PRC), and the coupling between neurons generate complex firing patterns in CPGs. The novelty of our approach resides in the realistic analysis of common input waveforms. We found for example that in a rectangular pulse, doubling the stimulus strength did not produce the same effect as doubling its duration. This suggests that the temporal dimension has a privileged role during information processing compared to stimulus intensity. Our study suggests that this effect can be traced down to cellular level. Our results also infer that temporal perception distortions, such as those observed in schizophrenia, can be related to the temporal component of a stimulus. We believe that re-adjustment of the chemical and electrical environment of the cell must be done such that the PRC mapping between objective and subjective time become once again (almost) linear.

## THE USE OF ACCUBEADS AS A QUALITY CONTROL MEASURE FOR THE COMPUTER AUTOMATED SEMEN ANALYZER

Darian D. Vernon<sup>1</sup>, Jane E. Johnson<sup>2</sup>, Angela M. Houwing<sup>2</sup>, H. Lee Higdon III<sup>2</sup>, and William R. Boone<sup>2</sup>

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The ability to verify the accuracy and precision of a diagnostic instrument is essential, especially in the medical field. The computer automated semen analyzer (CASA) is no exception. Though CASA has proven to be accurate in a specified range of sperm concentrations, imprecision errors can arise from various sources. The purpose of this study is to determine the precision and accuracy of Accu-Beads and their utility as a quality control (QC) product for CASA. This is a retrospective observational study conducted at an Assisted Reproductive Technology laboratory in tertiary-care, university hospital. We found that the means  $\pm$  1SD in M/mL for the two vials of Accu-Beads analyzed by two different methods were as follows: Vial 1 CASA,  $42.7 \pm 3.48$ ; Vial 1 Manual,  $42.6 \pm 3.45$ ; Vial 2 CASA,  $22.8 \pm 2.21$ ; and Vial 2 Manual,  $22.9 \pm 2.81$ . The CASA counts did not vary significantly from the manual counts for Vial 1 or for Vial 2. The bead concentrations listed by the manufacturer for each vial were below the 95% confidence interval for the values we obtained. In conclusion, Accu-beads meet enough of the requirements of a good control material to be acceptable for daily QC use, especially if we set our own ranges of acceptability for each vial of Accu-Beads.

## TEMPERATURE VARIATIONS WITHIN AND BETWEEN INCUBATORS

Meredith W. Walker<sup>1</sup>, Julia M. Butler<sup>2</sup>, H. Lee Higdon III<sup>2</sup>, and William R. Boone<sup>2</sup>

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There are many variables to take into consideration to have a successful assisted reproduction technology (ART) program. One such variable is temperature. Numerous studies have been conducted to investigate the affect temperature has on embryo development and pregnancy rates. Because temperature has a direct impact on embryo homeostasis, it is important to monitor and control temperatures in the ART laboratory. The aim of this study is to investigate temperature differentials inside front loading incubators typically used in ART laboratories. With the use of wireless temperature probes, temperature between the front and back of the incubator as well as temperature between and among the shelves are evaluated. This was a prospective, experimental trial with external controls that was conducted at an ART laboratory in tertiary-care, university hospital. The same make and model incubators had significantly different temperature readings even though they were both set to 37.0°C. There were significant temperature differences among top, middle and bottom shelves as well as significant temperature differences between the fronts and backs of shelves. There are temperature differences within and between our front-loading incubators. Thus, laboratory personnel should evaluate their incubators and determine if there are differences within and between their incubators and if so, what, if anything, should be done to correct these differences.

## CHANGES IN COMMUNITY STRUCTURE OF TWO INVASIVE BIVALVES IN LAKE ERIE

Thomas Walker, Dr. Ann Stoeckmann, and Jeff Steinmetz

Department of Biology, Francis Marion University

The invasive zebra mussels, *Dreissena polymorpha*, and their invasive counterpart and close relative the quagga mussel, *Dreissena rostriformis bugensis*, were first discovered in North America in the late 1980's. They were first found in and around the Great Lakes, most specifically Lake Erie. They were likely introduced in the ballast water of ships carrying cargo from Europe. The massive quantities of these mussels have caused problems and brought about concern in certain industries. The most concerning is the settling and maturing of these mussels inside water pipes branching from Lake Erie sometimes blocking all water flow. This experiment was designed to keep track of the proportions of each species in these bodies of water over a period of time and the effects of predation on mussels' population by another invasive species, the Round Goby. Data collection began in 1998 and was done intermittently until 2010. The most recent collection of samples from 2010 is what was analyzed in this specific project. First benthic samples (64 cm<sup>2</sup>) from the western basin of Lake Erie collected from a rock 4 meters deep were analyzed. The mussels were separated by species and individuals were measured for shell length. Then bodies from a range of shell lengths were dissected out of their shell. These bodies were desiccated in a 60°C oven and were then weighed. These body weights provided a regression so individual's weights could be estimated. To test the effects of predation by an invasive, bottom dwelling Goby fish, three separate lines holding plexi-glass plates measuring 3 x 5 cm<sup>2</sup> were attached 2 meters above the bottom to a cement block and suspended by a buoy. The plates were in the water column out of the way of predation by the goby and were also protected by a cage. These plates acted as a settling material for the veliger larvae. The plates were left in the water May-August 2010 and were then collected. The mussels that had developed on these plates were counted, divided by species, and measured for shell length. This experiment gathered data from three different benthic samples and three plates. In the 2008 samples there was a 50% increase in total mussel density. Quaggas were the dominant species making up 71% of the population and 62% of the settlers on the plates. The settlers would also have substantially contributed to the community if there were no predation by gobies. In preliminary data from the 2010 samples we found that Quaggas still seem to be the dominant species on the bottom making up 88.1% of the population. However on the plates, Quaggas only represent 48.4% of the settlers.

## DEID – A TOOL FOR DE-IDENTIFYING NEUROIMAGING DATASETS

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Loretta J. Morris<sup>2</sup>, Mark A. Eckert<sup>2</sup>

<sup>2</sup>Department of Health Science and Research, Medical University of South Carolina

A barrier to sharing existing data is the cumbersome process of manually de-identifying data that includes providing unlinked labels or filenames to multiple data sources from multiple subjects so that data cannot be tracked back to identifying information. In addition, voxel representing the face must also be removed when sharing neuroimaging data. We are developing DeID, a tool for sharing de-identified neuroimaging and behavioral/demographic datasets that automates the de-identification process. DeID provides a user-friendly interface to select T1-weighted images that will be skull-stripped and a spreadsheet containing data for the sample. DeID supports several image formats including NIfTI files, Analyze files and DICOM files. DeID also flexibly matches image files and behavioral/demographic data to provide new labels across data files with auditing functions to check on the matching of data files for each case and quality of skull-stripping. The de-identified data can then be transferred to a remote location through secure FTP so that the data can be stored into database for sharing. DeID will be made available through the NITRC. This work was supported by R01 HD069374-01 and was conducted in a facility constructed with support from Research Facilities Improvement Program (NCRR C06 RR14516).

## EVIDENCE OF GENETIC VARIATION AND ADAPTIVE PHENOTYPIC PLASTICITY IN TWO INVASIVE ANNUAL GRASSES IN CALIFORNIA

Shana J Woodward and Andy Dyer

Department of Biology & Geology, USC Aiken

California is a climatically diverse state and has a large number of invasive species dominating its ecosystems. Many annual grass species have invaded in the past 200 years and have become locally adapted since then. These invasive species are often phenotypically plastic and can therefore establish in a wide range of environmental conditions. We asked whether there is a trade-off between local adaptation and phenotypic plasticity in two species of invasive annual grasses. That is, as the species became more adapted to local conditions, is their ability to respond plastically reduced? We collected six populations of two species of widely-distributed annual grasses along a 10-fold rainfall gradient from southern to northern California. Preliminary data showed genetic differences in flowering time of one of the species. Therefore, we initiated a multi-factor experiment on both species to test for genetic differences between the populations and to test the range of plastic response within the populations. We looked for among and between population responses to both soil quality and resource availability. Plants were grown under greenhouse conditions with 15 replicates of all treatments. We predict that populations at the extremes of the rainfall gradient will be more genetically distinct and less phenotypically plastic than populations collected from the more climatically moderate areas.

## BIOMASS FEEDSTOCK IN THE UNITED STATES

Cory Wright

Morris College

This paper describes important biomass feedstocks in the United States. Researchers at the U.S. Department of Energy (DOE) at Oak Ridge National Laboratory (ORNL) have been working for more than 30 years to discover biomass to use for energy and other products. ORNL has concentrated on the development of biomass feedstocks for liquid transportation fuels, electric power, and other bioproducts. Biomass feedstocks include crops grown in agricultural and forestry operations, and waste products from both. By growing biomass, we can use it for fuels, as well as animal feed, food, and fiber. Biomass from cellulosic sources has increased because of wild changes in prices of traditional energy resources such as gasoline. By conducting a literature search, a great deal of information was discovered on different biomass sources and describes what might be done in the future. It is clear that using biomass can help producers and consumers in many environmentally and economically beneficial ways. For biomass to be developed, there are models that help understand how enough biomass might become available by the year 2030. The biomass has a supply chain which starts with crop production through handling and storage, and ends with the bioproducts or energy for consumers to use. Some of the top feedstocks used today are corn, wheat, and native grasses. Biomass to energy is as important as biomass for food, feed, and fiber.

## ACTH AFFECTS ACID CERAMIDASE EXPRESSION IN ADRENAL CORTEX CELLS

Heather Yancey, Lorianne Stehouwer Turner, Teresa Herzog, Krissy Smith, Lenton Holley, Christopher Johnson, and

Timothy Prince

Department of Biology, Francis Marion University

Acid ceramidase (AC) is an enzyme that converts ceramide, a lipid molecule that can signal apoptosis, to sphingosine, which is converted to the pro-survival molecule sphingosine-1-phosphate. AC up-regulation has been linked to resistance to ceramide-induced cell death in prostate cancer cells. Cortisol is a steroid stress hormone produced by adrenal cells in response to adrenocorticotrophic hormone (ACTH) released by the pituitary gland. Published studies have shown that ACTH can also alter acid ceramidase expression, suggesting a relationship between stress pathways and cancer. We are evaluating how exogenous ACTH treatment affects AC expression levels in H295R cells, and if this confers resistance to ceramide-induced cell death.

Understanding the relationship between ACTH and AC may offer insight into the relationship between the biological factors associated with psychological stress and the development of cancer.

#### QUEUE LENGTH ESTIMATION FROM PROBE VEHICLES AT SIGNALIZED INTERSECTIONS

Kenneth Yeadon, Gurcan Comert, Gary Knight, Tatyanna Taylor, April Chappell,  
Tia Herring, Biegon Winnifer, and Hohite Fetene  
Physics and Engineering Department, Benedict College

This research develops models for the real-time estimation of the queue lengths at traffic signals using some of the fundamental information (e.g., location, time, and count) that probe vehicles (i.e., vehicles equipped with GPS and wireless communication technologies) provide. For a single queue with Poisson arrivals, analytical models are developed to evaluate how error changes in estimation as percentage of probe vehicles in the traffic stream varies. When the overflow queue is ignored, closed-form solutions are obtained for the squared error loss of the estimation error. When probe percentage  $p$  and flow  $\lambda$  of the traffic are unknown, some estimators are given and compared based on their squared error losses. The study also investigates possible deployment of developed models in queue length estimation from probe vehicles at signalized intersections. Several alternative arrival distributions are listed to be incorporated into the estimation models. Ultimately, models are evaluated using VISSIM microscopic simulation environment.

#### ONTOLOGY GRAPH BASED QUERY EXPANSION FOR BIOMEDICAL INFORMATION RETRIEVAL

Yuanyuan Zhang and James Wang  
School of Computing, Clemson University

With the continuously increasing of the amount and diversity of available biomedical information, there is a higher demand of an efficient and effective biomedical information retrieval (BIR) technology. In this paper, we propose an ontology-graph based approach to implement query expansion for biomedical information through constructing an ontology graph using multiple vocabularies from Metathesaurus. We used Personalized Pagerank algorithm to rank the terms during query expansion process. The OHSUMED test collection was used as a test corpus. Our experiment showed that the proposed method provided excellent query performance.

**END**

SC Academy of Science Abstracts  
(Sr. Academy)

**SOUTH CAROLINA JUNIOR ACADEMY OF SCIENCE  
SCHEDULE OF EVENTS**

**Saturday, April 13<sup>th</sup>**

<b>7:30- 9:00 AM</b>	<b>SCJAS Registration</b>	<b>Antidel Chapel &amp; Oval Area</b>
<b>8:30-9:00 AM.</b>	<b>Welcome</b> Dr. David H. Swinton, President, Benedict College Dr. Prakash Nagarkatti, Vice-President for Research, USC Dr. Samir Raychoudhury, Dean, STEM, Benedict College	<b>Antidel Chapel</b>
	<b>Introduction of Speaker</b> Dr. Pearl Fernandes, USC Sumter, President-Elect SCAS	
<b>9:00-9:30 AM</b>	<b>Plenary Session I Speaker</b> Dr. Saundra Glover, Director of Institute for Partnerships to Eliminate Health Disparities, USC	
<b>9:45-11:45 AM</b>	<b>SCJAS Morning Sessions:</b>	<b>BC Cares (basement floor) of Benjamin Payton LRC Bldg</b>
<b>9:45-11:45 AM</b>	<b>Regional Science Fair Winners Poster Presentations</b>	
<b>11:45 AM-1:30 PM</b>	<b>Lunch</b>	<b>Lobby of Henry Ponder Fine Arts Center</b>
<b>1:00-2:15 PM</b>	<b>SCJAS Afternoon Sessions:</b>	<b>BC Cares (basement floor) of Benjamin Payton LRC Bldg</b>
<b>1:30-2:15 PM</b>	<b>Plenary Session II Speaker</b> Dr. Melissa Moss, Department of Chemical Engineering, USC	<b>Antidel Chapel</b>
<b>3:00-4:00 PM</b>	<b>Howard Burnham Presentation</b> "On the shoulders of Giants"	<b>HRC Arena</b>
<b>4:00-4:30 PM</b>	<b>Careers in Pharmacy</b> Katie Golfus Wingate University Department of Pharmacy	<b>Benjamin Mays HRC Arena</b>
<b>4:30-5:00 PM</b>	<b>SCJAS door prize drawings and pizza dinner</b>	<b>Benjamin Mays HRC Arena</b>
<b>5:00-6:00 PM</b>	<b>SCJAS Award Ceremony</b>	<b>Benjamin Mays HRC Arena</b>

## 2013 SCJAS Award Ceremony Schedule

### Welcome:

Dr. Tom Reeves, Midlands Technical College, SCJAS Executive Director

### The American Association for Biochemistry & Molecular Biology (ASBMB) Award

Award amount: \$50 each in Biochemistry and Molecular Biology category

Presenter: Representative from Winthrop University

### Southern Atlantic Coast Section of the American Association of Physics Teachers Award

Award amount; \$100 for student winner and teacher sponsor

Presenter: Dr. Mikhail M. Agrest, Physics & Astronomy Dept. College of Charleston

### Winthrop University Behavioral Science Award

Award Amount: \$50 each for oral presentation and written presentation participants in category of Psychology and Sociology

Presenter: Dr. Edna Steele, Converse College

### Winthrop University Excellence in Biology Award

Award Amount: \$50 each for participant in category of Botany

Presenter: Dr. Edna Steele, Converse College

### Winthrop University Excellence in Environmental Science Award

Award Amount: \$50 each for participant in category of Environmental Science

Presenter: Dr. Edna Steele, Converse College

### South Carolina Bank & Trust Consumer Affairs Research Award

Award Amount: \$50 each for oral presentation and written presentation participants in category of Consumer Affairs

Presenter: Dr. Edna Steele, Converse College

### Daniel Antion Chemistry Award

Award amount: \$100 first place in Oral Presentation for category of Non-mentored Chemistry

Award amount: \$50 second place in Oral Presentation for category of Non-mentored Chemistry

Award amount: \$25 third place in Oral Presentation for category of Non-mentored Chemistry

Presenter: Dr. Jim Privett, USC Sumter

### South Carolina Section of the American Chemical Society

Award Amount: one year subscription to ChemMatters to all presenters in categories of Chemistry and Biochemistry

Presenter: Dr. Jim Privett, USC Sumter

### 2012 SCJAS Written Presentations

Presenter: Dr. Jim Privett, USC Sumter

### 2011 SCJAS Oral Presentations

Presenter: Dr. Edna Steele, Converse College

### 2011 SCJAS Poster Sessions

Presenter: Tammy Taylor, Midlands Technical College

### Nominations for 2014 AJAS Meeting

13<sup>th</sup> – 17<sup>th</sup> in Chicago, Illinois

Presenter: Tammy Taylor, Midlands Technical College

### Closing remarks

Tammy Taylor, Midlands Technical College



## 2013 SCJAS JUDGES

### **Biochemistry(M, NM)**

\*Dr. Mahtabuddin Ahmed, Professor, South Carolina State University  
Dr. Helene Tamboue, Professor, Benedict College

### **Botany (M, NM)**

\*Dr. Henry Slone, Associate Professor of Biology, Francis Marion University

### **Cell &Molecular Biology (M)**

\*Dr. Brian Dominy, Associate Professor, Clemson University  
Dr. Virginia Probin, Assistant Professor, Charleston Southern University

### **Chemistry (M, NM)**

\*Dr. Hanno zur Loye, Professor of Chemistry, University of South Carolina Columbia  
Dr. Rahina Mahtab, Professor of Chemistry, South Carolina State University

### **Consumer Affairs**

\*Dr. Rebecca Hanckel, Associate Professor of Chemistry, Charleston Southern University  
Johanna O. Killoy, Retired Teacher

### **Engineering (M,NM)**

\* Dr. Thomas W. Simpson, Senior Instructor of Mathematics, USC Union  
Dr. John Dickerson, Professor Emeritus, USC Columbia

### **Environmental Science (M)**

\*Dr. Jerry Howe, Professor of Chemistry, Converse College

### **Environmental Science (NM)**

\*Dr. Samuel Darko, Associate Professor, Benedict College

### **Mathematics & Computer Science (M,NM)**

\*Odysseas Kakaras, Instructor of Mathematics, USC Sumter  
Dr. Hong Jiang, Associate Professor, Benedict College

### **Microbiology (M,NM)**

\*Dr. Kajal Ghoshroy, Assistant Professor of Biology, USC Sumter  
Daniel Kiernan, Instructor of Biology, USC Sumter

### **Physics (NM)**

\*Dr. Robert Nerbun, Professor of Physics, USC Sumter  
Dr. Ze Zhang, Associate Professor of Computer Science, Coker College

### **Physiology and Health (M)**

\*Dr. Ajoy Chakrabarti, Professor of Biology, South Carolina State University

### **Physiology and Health (NM)**

\*Dr. Steve Bishoff, Associate Professor of Biology, USC Sumter

### **Psychology & Sociology (NM)**

\*Tai McMiller, Instructor of Psychology, York Technical College  
Dr. Nancy Macdonald, Associate Professor of Psychology, USC Sumter

### **Zoology (M,NM)**

\*Ms. Sukla Chakrabarti, Retired Science Teacher  
Dr. Roger Schmidt, Associate Professor of Biology, Columbia College

\* Lead Judge

**SCJAS 2011 ANNUAL MEETING ORAL PRESENTATIONS  
BENEDICT COLLEGE, APRIL 13, 2012**

**Biochemistry – Mentored  
Room 210 Alumni Hall**

- 8:15 AM Hilda Chan, Governor's School for Science & Math  
CONCURRENT DELIVERY OF HYDROPHILIC PROTEIN AND LIPOPHILIC  
DRUG BY FACILELY PREPARED SELF-ASSEMBLED COLLOIDAL  
NANOPARTICLES
- 8:30 AM Kristin Hardy, Governor's School for Science & Math  
THE DOSE DEPENDENCY OF EPIGALLOCATECHIN-3-GALLATE ON THE  
INHIBITION OF AMYLOID-B MONOMER AGGREGATION IN ALZHEIMER'S  
DISEASE
- 8:45 AM Riley Blocker, Governor's School for Science & Math  
EVALUATING FE<sup>2+</sup> RELEASE BY THE MITOCHONDRIAL NA<sup>+</sup>/CA<sup>2+</sup>  
EXCHANGER
- 9:00 AM Hannah Kahng, Governor's School for Science & Math  
STUDY OF VARIOUS LEVELS OF PROTEIN EXPRESSION IN THE INACTIVE  
STATE OF DIFFERENT CONCENTRATIONS OF HUMAN THYMDYLATE  
SYNTHASE
- 9:15 AM Jason Eckert, Governor's School for Science & Math  
THE CREATION OF A STABLE NANOCOLLOID CONSISTING OF POLYMER  
BILAYER ENCAPSULATED NANOPARTICLES OF PACLITAXEL
- 9:30 AM Joseph Park, Governor's School for Science & Math  
PROTEASE ACTIVATED RECEPTOR-1 (PAR-1) STIMULATED SCHWANN CELL  
DEATH IS A RESULT OF APOPTOSIS AS DETERMINED BY TERMINAL  
DEOXYNUCLEOTIDYL TRANSFERASE DUTP NICK END LABELING (TUNEL)
- 9:45: AM Ya Fang, Governor's School for Science & Math  
THE EFFECT OF 5-FLURO-2'-DEOXYURIDINE ON THE INCORPORATION OF 5-  
IODO-2'-DEOXURIDINE IN DNA OF HT-29 CELL
- 10:00 AM Break
- 10:15 AM Royal Pipaliya, Governor's School for Science & Math  
STRUCTURAL CHARACTERIZATION OF AMIC, AN N-ACETYLMURAMYL-L-  
ALANINE AMIDASE IN NEISSERIA GONORRHOEAE
- 10:30 AM Sherly Boddu, Governor's School for Science & Math  
PHYLOGENETIC RELATIONSHIPS OF SIGNAL PEPTIDE PEPTIDASE AND  
RELATED PEPTIDASES IN SACCHAROMYCES CEREVISIAE
- 10:45 AM Taylor Banks, Governor's School for Science & Math  
THE STUDY OF VIOLET AND NEAR INFRARED ABSORBING  
CHROMOPHORES FOR BIFUNCTIONAL DNA OLIGONUCLEOTIDES

**Biochemistry/ Non-mentored**

**Room 210 Alumni Hall**

- 11:30 AM Chelsea Joseph, Heathwood Hall Episcopal School  
THE PERCENT PRESENCE OF GMO- ASSOCIATED DNA SEQUENCES IN 3  
DIFFERENT BRANDS OF BACON
- 11:45 AM Manushi Patel,. Spring Valley High School  
A COMPARISON ON THE EFFECTS OF DIVALENT AND TRIVALENT CATIONS  
ON THE SWELLING PROPERTIES OF SUPERPOROUS HYDROGEL HYBRIDS  
IN A GASTRIC ENVIRONMENT
- 12:00 PM Ben Fechter, Spring Valley High School  
THE CARCINOGENIC EFFECTS OF TRICLOSAN AND ITS PHOTOLYTIC  
DERIVATIVES
- 12:15 PM Ankit Bilgi and Roshni Maldi, Southside High School  
BAMBOO AS A CANDIDATE FOR CELLULOSIC ETHANOL PRODUCTION

**Botany – Mentored**

**Room 212 Alumni Hall**

- 8:30 AM Katherine Rebholz, Governor's School for Science & Math  
FUNCTIONAL CHARACTERIZATION OF THE SOYBEAN E3 LIGASE GENE  
GMSIZ1
- 8:45 AM Hezikyah Olenja, Governor's School for Science & Math  
CLONING OF MARKER GENES FOR VIRUS-INDUCED GENE SILENCING IN  
PRUNUS PERSICA
- 9:00 AM Lydia Givins, Governor's School for Science & Math  
EVALUATION OF ANTIOXIDANT, PHENOLIC AND ANTHOCYANIN CONTENT  
IN PEACHES [PRUNUS PERSICA (L.) BATSCH]
- 9:15 AM Gabi McNulty, Governor's School for Science & Math  
DEVELOPMENT OF DISEASE-RESISTANT POPLAR TREES USING GENETIC  
ENGINEERING

**Botany / Non-mentored**

**Room 212 Alumni Hall**

- 9:30 AM Olivia Bell, Heathwood Hall Episcopal School  
THE EFFECT OF VARIOUS GROWING MEDIUMS IN A HYDROPONIC SYSTEM  
ON THE GROWTH OF WISCONSIN FAST PLANTS (BRASSICA RAPA)
- 9:45 AM Sonali Parmar, Heathwood Hall Episcopal School  
THE EFFECT OF COMMON HOUSEHOLD LIQUIDS ON ABELMOSCHUS  
ESCULENTUS'S GERMINATION RATE
- 10:00 AM Break

- 10:15 AM Adiv Sivakumar, Spring Valley High School  
THE EFFECT OF CRUSHED BROWN AND WHITE EGGSHELLS EMBEDDED IN SOIL ON THE HEIGHT OF BRASSICA RAPA
- 10:30 AM Hannah McCall, Spring Valley High School  
THE EFFECT OF EXPOSURE TO ULTRAVIOLET B RADIATION ON THE GROWTH OF RAPHANUS SATIVUS
- 10:45 AM Leila Yazdi, Spring Valley High School  
THE EFFECT OF CLAY PELLETS AND COCONUT COIR ON THE GROWTH OF PISUM SATIVUM VAR. SATIVUM
- 11:00 AM Ayan Dasgupta, Hammond School  
DOES THE HEIGHT OF A TREE CORRELATE WITH ANY OTHER PHYSICAL CHARACTERISTICS OF THE TREE
- 11:15 AM Nabihah Kumte, Spring Valley High School  
THE EFFECT OF SOIL SALINITY ON THE OXYGEN PRODUCTION OF PISUM SATIVUM VAR SATIVUM
- 11:30 AM Eric Doan, Tiffany Kaissal and Sophia Yin, Southside High School  
AN ANALYSIS OF THE DETRIMENTAL EFFECTS OF IDLING A CAR ON VIOLA TRICOLOR

**Cellular & Molecular Biology/Mentored**  
**Room 303 Alumni Hall**

- 8:30 AM Surya Veerabagu, Governor's School for Science & Math  
CHARACTERIZING MIR-218 AND ITS ROLE IN COLON CANCER METASTASIS
- 8:45 AM Jason Erno, Spring Valley High School  
SCREENING MIRNAS FOR THE GREATEST KNOCKDOWN OF THE KAINTE RECEPTOR SUBUNIT KA2
- 9:00 AM Colman Moore, Governor's School for Science & Math  
AXONAL GUIDANCE OF SINGLE CHICK FOREBRAIN NEURONS IN VITRO BY GEOMETRIC AND MORPHOLOGIC STIMULI
- 9:15 AM Laura Campbell, Governor's School for Science & Math  
INTERFERON- $\gamma$  DEPENDENT DEVELOPMENT OF VITILIGO
- 9:30 AM Nicole Cyr, Governor's School for Science & Math  
REGULATION OF INSULIN/IGF-1 SIGNAL TRANSDUCTION BY O-LINKED N-ACETYLGLUCOSAMINE MODIFICATION OF INSULIN RECEPTOR SUBSTRATE 2
- 9:45 AM Megan Hunt, Academic Magnet High School  
THE EFFECTS OF SPHINGOSINE-1-PHOSPHATE ON THE DEVELOPMENT OF ATHEROSCLEROSIS
- 10:00 AM Eliza Rhodes, Governor's School for Science & Math  
UP-REGULATION OF L1CAM ISOFORMS BY TGF-B IN CANCER CELLS

- 10:15 AM Break
- 10:30 AM Michelle Choe, Governor's School for Science & Math  
THE EFFECT OF MAST CELL INHIBITION ON TUMOR RESPONSE TO 5-FU
- 10:45 AM Savannah DiClementi, Governor's School for Science & Math  
TRENDS IN POPULATIONS OF MICROGLIA IN THE DEVELOPING AUDITORY NERVE
- 11:00 AM Tyler Harvey, Governor's School for Science & Math  
KRUPPEL-LIKE FACTOR 4 ALPHA (KLF4A) SUPPRESSES BREAST CANCER DEVELOPMENT
- 11:15 AM Victoria Perdue Governor's School for Science & Math  
RETINOIC ACID SHIFTS THE SENSITIVITY OF FIBROBLASTS TO TRANSFORMING GROWTH FACTOR 2-INDUCED SMAD2 ACTIVATION
- 11:30 AM Annie McDermott, Academic Magnet High School  
STRATIFICATION OF RENAL EPITHELIAL NEOPLASMS USING SINGLE NUCLEOTIDE POLYMORPHISM [ SNP] MICROARRAY ANALYSIS

**Cellular & Molecular Biology/Non- Mentored**  
**Room 303 Alumni Hall**

- 11:45 AM Habiba Fayyaz, Spring Valley High School  
INHIBITORY EFFECTS OF SODIUM DEOXYCHOLATE ON THE FIBRIL FORMATION OF AB PEPTIDES

**Chemistry/ Mentored**  
**Room 219 Alumni Hall**

- 8:30 AM Michael Keating, Governor's School for Science & Math  
SYNTHESIS AND SINTERING OF YTTRIUM ALUMINUM GARNET (YAG)
- 8:45 AM Menshian George, Governor's School for Science & Math  
THE CREATION OF HOST-GUEST COMPLEXES OF NAPHTHALENE-DIOL CO-CRYSTALLIZED IN CONJUNCTION WITH GUEST MOLECULES FOR COMPARISON WITH  $\alpha$ -CYCLODEXTRIN
- 9:00 AM Hazel Davis, Governor's School for Science & Math  
UTILIZING POLYMERASE CHAIN REACTION AND AGAROSE GELS TO INVESTIGATE THE INTERACTION OF POTENTIAL CHROMIUM (III) ANTICANCER DRUGS WITH DNA
- 9:15 AM Aaron McGinnis, Governor's School for Science & Math  
FLUOROPHORE SEPARATION AND FINDING CONCENTRATION IN MIXTURES OF RHODAMINE 6G AND FLUORESCENT BEADS
- 9:30 AM Rachel Chen, Governor's School for Science & Math  
SYNTHESIS AND BIOLOGICAL EVALUATION OF POLYAMINOHYDROXAMIC ACID ON MCF-10A AND MCF-7

9:45 AM Ben Hardaway, Governor's School for Science & Math  
SYNTHESIS, STRUCTURES, AND OPTICAL PROPERTIES NA5LN4GE4O16(OH),  
NALNGEO4, AND LNO(OH) (LN=SM,EU,GD)

10:00 AM Break

**Chemistry/ Non-mentored**  
**Room 219 Alumni Hall**

10:15 AM Sam Nassab, Heathwood Hall Episcopal School  
THE EFFECT OF pH LEVELS OF THREE, SEVEN AND TEN ON THE AMOUNT  
OF FLUORIDE IONS RELEASED BY A FLUORIDE RELEASING DENTAL  
SEALANT

10:30 AM Amber Parnell, Spring Valley High School  
GLYCEROL'S EFFECT ON THE AMOUNT OF EXTRACTED LIGNIN IN THE  
PRETREATMENT OF CELLULOSIC ETHANOL

10:45 AM Lance Murphy, Spring Valley High School  
A STUDY OF THE POLY(ACRYLAMIDE) HYDROGEL, THE POLY(2-  
ACRYLAMIDO-2-METHYLPROPANESULFONIC ACID) HYDROGEL, THE  
POLY(2-ACRYLAMIDO-2-METHYLPROPANESULFONIC ACID)/  
POLY(ACRYLAMIDE) DOUBLE-NETWORK HYDROGEL, AND THE  
POLY(ETHYLENE GLYCOL)/GELATIN METHACRYLATE COMPOUND  
HYDROGEL

11:00 AM Katie Beach, Heathwood Hall Episcopal School  
THE RELATIONSHIP BETWEEN VARYING GEOGRAPHICAL REGIONS AND  
THE AMOUNT OF LEAD IONS IN HAIR SAMPLES

11:15 AM Jessica Withycombe, Heathwood Hall Episcopal School  
THE EFFECT OF CHANGING ACID CONCENTRATION ON THE AMOUNT OF  
SILVER IONS (MG/L) THAT LEAK FROM SILVER INFUSED FOOD STORAGE  
CONTAINERS

11:30 AM Natalie Hicks, Greenville Tech Charter School  
THE EFFECT OF COSMETICS ON SUSSCROFA DOMESITUCS SKIN

11:45 Lunch

1:00:PM Rimel Mwamba, Spring Valley High School  
THE EFFECT OF DIFFERING CALCIUM CHLORIDE CONCENTRATIONS ON  
THE DIFFUSIVE ESCAPE RATE OF CALCIUM ALGINATE HYDROGELS

1:15 PM Stefanie Martin, Spring Valley High School  
THE EFFECTS OF UV RADIATION ON THE DEGRADATION OF CALCIUM  
OXALATE

1:30 PM Joey Bonitati, Zack Free and Joeseeph Clinton, Southside High School  
THE USE OF LARD IN THE PRODUCTION OF BIODEISELS

1:45 PM Kristy Abd-El-Malak, Dustin Cai and Ramya Kappagantula, Southside High School  
THE TREATMENT OF PLANTS WITH BORIC ACID FOR FIRE RETARDATION

2:00 PM David Wilson, Cannon Palms and David Wilson, Southside High School  
AN ANALYSIS ON THE CREATION, COMPOSITION, AND STRUCTURE OF BIO-  
PLASTICS

**Consumer Affairs/Mentored**  
**Room 305 Alumni Hall**

8:30 AM Ashmitha Thinagar, Governor's School for Science & Math  
THE IDENTIFICATION AND ANALYSIS OF SOUTH CAROLINA'S FAILING  
INDUSTRIES AND THE CREATION OF A STATISICAL FORECAST FOR THE  
STATE'S ECONOMIC RECOVERY

8:45 AM Marissa Nino, Governor's School for Science & Math  
INCREASING USABILITY OF TIME-SERIES HEALTH AND FITNESS DATA TO  
MOTIVATE A PHYSICALLY INACTIVE AUDIENCE

9:00 AM Will Damron, Governor's School for Science & Math  
DEPENDENCE STRUCTURE OF US STOCK MARKET IN VIEW OF LONG-  
RANGE CROSS-CORRELATION

9:15 AM Sid Bhadauria, Governor's School for Science & Math  
RECOMMENDATIONS TO IMPROVE AND ENHANCE THE TIRE SUBCLUSTER  
IN SOUTH CAROLINA

**Consumer Affairs/Non-mentored**  
**305 Alumni Hall**

9:30 AM Alexis McCullough, Heathwood Hall Episcopal School  
THE EFFECT OF DIFFERENT WASH TREATMENTS ON THE RATE AND  
AMOUNT OF MOLD GROWTH ON SUPERMARKET STRAWBERRIES

9:45 AM Donen Davis, Heathwood Hall Episcopal School  
WHICH INSECT REPELLENT IS MOST EFFECTIVE WHEN TRYING TO KEEP  
MOSQUITOES OUT OF A SCREENED-IN AREA?

10:00 AM Madison Mason, Heathwood Hall Episcopal School  
PHYSIO TAPE VS KINESIO TAPE: A COMPARISON OF ELASTIC PROPERTIES

10:15 AM Break

10:30 AM Rachael Bates, Heathwood Hall Episcopal School  
THE EFFECT OF RAIL AND JUMP CUP MATERIAL ON ANGLE OF PULLBACK  
OF A PENDULUM REQUIRED TO DISLODGE A JUMP

10:45 AM Walker Comer & David Williams, Heathwood Hall Episcopal School  
THE EFFECT OF SHOT TYPE ON PELLETS INSIDE THE DEFINED TARGET  
AREA

11:00 AM Justin Stombler, Spring Valley High School  
THE EFFECT OF TIME OF EXPOSURE TO UV RADIATION ON THE EFFICACY  
OF CHLORINE DIOXIDE AND IODINE WATER PURIFICATION TABLETS

11:15 AM Jordan Motlong, Spring Valley High School  
THE EFFECT OF THE PARTICLE SIZE OF SODA LIME ON THE AMOUNT OF  
TIME IT TAKES FOR AN UNSAFE CARBON DIOXIDE LEVEL TO BE REACHED

**Middle School Division**  
**Room 105 Alumni Hall**

11:30 AM Erfan Jabari, Hammond School  
EFFECT OF DIFFERENT LIQUIDS ON MAGNETIC FIELD

11:45 PM Sumant Rao, Hammond School  
MOTIVATION IN RUNNING

**Engineering/Mentored**  
**Room 302 Alumni Hall**

8:45 AM Ianara Natividad, Governor's School for Science & Math  
PARTICLE DEFLECTION IN MICRO-FABRICATED CHANNELS CAUSED BY  
MAGNETIC FIELDS

9:00 AM Andrew Shealy, Governor's School for Science & Math  
MINIMIZING PHEV EMISSIONS AND ENERGY CONSUMPTION USING  
CONNECTED VEHICLE TECHNOLOGY TO PREDICT SIGNAL TIMING AND  
SPEED PROFILE INFORMATION

9:15 AM Brian Hurst, Governor's School for Science & Math  
THE CONSTRUCTION AND VALIDATION OF AN ELLIPSOMETER THROUGH  
THE MEASUREMENT OF AL<sub>2</sub>O<sub>3</sub> FILM ON SILICON

9:30 AM Joey Wilson, Governor's School for Science & Math  
LOW-COST BLOOD GLUCOSE MONITORING SYSTEM WITH PRINTED ON-  
DEMAND TEST STRIPS FOR IMPLEMENTATION IN RESOURCE-POOR  
SETTINGS

9:45 AM Michelle Frazier, Governor's School for Science & Math  
PIEZOELECTRIC WAFER ACTIVE SENSOR (PWAS) BASED STRUCTURAL  
HEALTH MONITORING (SHM) ON GLASS FIBER REINFORCED POLYMER  
(GFRP)

10:00 AM Michael Gray, Governor's School for Science & Math  
DEVELOPMENT OF LAPAROSCOPIC SIMULATOR FOR SURGICAL SKILL  
ASSESSMENT

10:15 AM Break



**Engineering/Non-mentored**  
**Room 302 Alumni Hall**

- 10:30 AM      Brenton Miller, Spring Valley High School  
A COMPARISON OF EFFICIENCY OF COMPACT FLUORESCENT LAMPS AND INCANDESCENT LAMPS
- 10:45 AM      Nicolas Quan, Heathwood Hall Episcopal School  
THE EFFECT OF A RECYCLED PAPER AGGREGATE ON THE TENSILE STRENGTH OF CONCRETE
- 11:00 AM      Arthur Robinson, Spring Valley High School  
THE EFFECT A CERAMIC THERMAL-INSULATOR ON THE AIR-INTAKE OF AN INTERNAL COMBUSTION ENGINE
- 11:15 AM      Logan Corn, Spring Valley High School  
THE EFFECTS OF POWER SAVING MODES ON WINDOWS 7 LAPTOPS POWER DRAW
- 11:30 AM      Mitchell England, Spring Valley High School  
THE EFFECT OF PISTON STROKE AND BORE DIMENSIONS ON THE AMOUNT OF FORCE REQUIRED TO CREATE ENOUGH PRESSURE FOR REVERSE OSMOSIS
- 11:45 AM      Richard Chen, Spring Valley High School  
A CONTACTLESS HAND RECOGNITION SYSTEM BASED ON GEOMETRIC RATIOS
- 12:00 PM      Lunch
- 1:15 PM      Jordan Byrne, Spring Valley High School  
INFLUENCE OF PH ON BORON REJECTION THROUGH A FIVE-STAGE HOME REVERSE OSMOSIS SYSTEM
- 1:30 PM      Martin Li, Spring Valley High School  
NATURAL LEADING EDGE VORTICES ON ACER DIABOLICUM BLUME INSPIRED WIND TURBINE BLADE
- 1:45 PM      Aakash Shingala, Spring Valley High School  
THE EFFECT OF MOLYBDENUM BASED COMPOUNDS ON THE ELECTROLYSIS RATE OF WATER

**Environmental Science/Mentored**  
**Room 311 Alumni Hall**

- 8:30 AM      Justine Flora, Spring Valley High School  
THE EFFECT OF WASHING HYDROCHAR ON THE ADSORPTION OF ATRAZINE SOLUTION
- 8:45 AM      Remy Barnwell, Governor's School for Science & Math  
THE EFFECTS OF NUTITIONAL IRON ON BIOFUEL ALGAE

- 9:00 AM Ashley McGovern, Governor's School for Science & Math  
THE EFFECT OF CLIMATE VARIABILITY ON THE BREEDING PHENOLOGY OF THE WOOD FROG, LITHOBATES SYLVATICA
- 9:15 AM Graham von Oehsen, Governor's School for Science & Math  
GROWTH OF CHLORELLA PROTOTHECOIDES IN BOTH REAL AND SYNTHETIC WASTEWATER FOR WASTEWATER TREATMENT AND BIOFUEL PURPOSES
- 9:30 AM Megan Chapman, Governor's School for Science & Math  
THE EFFECTS OF HISTORIC AND CURRENT LAND USE ON STREAM GEOMORPHOLOGY AND HABITAT QUALITY IN THE PIEDMONT REGION NEAR GREENVILLE, SOUTH CAROLINA
- 9:45 AM Kim McRae, Spring Valley High School  
TRACKING THYMIDYLATE SYNTHASE: FLUORESCENTLY MONITORING HCT 116 CELLS USING CLICK
- 10:00 AM Casey Stevenson, Greenville Tech Charter School  
ARTIFICIALLY CONSTRUCTED POLYMERS EXTRACT OIL FROM THE FEATHERS OF WATER FOWL AT A HIGHER EFFICIENCY THAN CONVENTIONAL METHODS
- 10:15 AM Break

**Environmental Science- Non-mentored**  
**Room 313 Alumni Hall**

- 8:30 AM Heather Pusey, Heathwood Hall Episcopal School  
THE EFFECT OF THE SOIL DISTANCE FROM OAT ANTIFREEZE SOLUTION SOURCE ON SOIL MACRONUTRIENTS ALONG WITH SOIL PH
- 8:45 AM Anna Farr & Sarah Stormer, Heathwood Hall Episcopal School  
THE EFFECT OF ABSCISIC ACID (ABA) AND AMOUNT OF WATER ON PLANT GROWTH, NUMBER OF LEAVES AND OVERALL HEALTH OF RAPID RADISH SEEDS
- 9:00 AM Jordan Withycombe, Heathwood Hall Episcopal School  
THE EFFECT OF BODY WRAPS ON THE DECOMPOSITION OF BURIED MUS MUSCULUS
- 9:15 AM Sunaina Kapur, Heathwood Hall Episcopal School  
THE EFFECT OF CONGAREE RIVER WATER SAMPLE PROXIMITY TO THE COLUMBIA METRO WWTP ON THE PRESENCE OF ANTIBIOTIC RESISTANT BACTERIA
- 9:30 AM Andrew White, Spring Valley High School  
THE EFFECT OF 1, 3, 7-TRIMETHYLYXANTHINE ON LIPID PRODUCTION IN BOTRYOCOCCUS BRAUNII
- 9:45 AM Lauren Rodgers, Spring Valley High School  
THE EFFECT OF RAISED CARBON DIOXIDE LEVELS IN SALT WATER ON THE OXYGEN PRODUCTION OF BACILLARIOPHYCEAE

- 10:00 AM Sara Wallam, Spring Valley High School  
THE EFFECTS OF LEAD CONTAMINATED SOIL ON THE METAL ACCUMULATION OF FAGOPYRUM ESCULENTUM MOENCH
- 10:15 AM Break
- 10:30 AM Zachary Wallick, Spring Valley High School  
THE EFFECTS OF ULTRAVIOLET RADIATION ON PHOTOINHIBITION OF ANABAENA
- 10:45 AM Elisabeth Brown, Spring Valley High School  
THE REMOVAL OF ARSENIC TRIOXIDE FROM AQUEOUS MEDIA USING VARYING FILTERING METHODS
- 11:00 AM Karen Lee, Spring Valley High School  
A COMPARISON OF CaCl<sub>2</sub> AND KCl MODIFIED ORANGE PEEL BIOSORBENTS ON THE ADSORPTION OF Cu<sup>2+</sup> FROM AQUEOUS SOLUTIONS
- 11:15 AM Jed Gist, Spring Valley High School  
A COMPARISON OF THE ABILITY OF SILICA-BASED AEROGEL, UV RADIATION EXPOSURE, DISTILLATION, AND SAND FILTRATION TO REMOVE IBUPROFEN FROM WATER
- 11:30 AM Meghan Franco, Spring Valley High School  
PREVENTION OF EUTROPHICATION: REMOVING EXCESS AMMONIA FROM WATER USING FLY ASH, NA-4-MICA, AND FANWORT (CABOMBA CAROLINIANA)
- 11:45 AM Meisha Draper, Spring Valley High School  
THE EFFECT OF VARIOUS ADDITIVES ON THE FREEZING POINT OF WATER FOR USE OF THE "LITER OF LIGHT" IN TEMPERATURES BELOW FREEZING
- 12:00 PM Sebastian Fearn, Spring Valley High School  
THE EFFECT OF UV EXPOSURE ON THE MASS OF VARIOUS PLASTICS PLACED IN OCEAN WATER
- 12:15 PM Song "Sarah" Lee, Spring Valley High School  
EFFECT OF MONTMORILLONITE AND ALUMINUM SULFATE ON THE FLOCCULATION OF CYANOBACTERIAL BLOOM
- 12:30 PM Lunch

**Math & Computer Science/Mentored**  
**Room 106 Alumni Hall**

- 11:00 AM Issac Roberts, Academic Magnet High School  
CREATING AN ARTIFICIALLY INTELLIGENT PLAYER FOR THE STUDENT STARCRAFT ARTIFICIAL INTELLIGENCE COMPETITION
- 11:15 AM TJ Melanson, Governor's School for Science & Math  
USING A VIRTUAL ENVIRONMENT AND SIMULTANEOUS LOCALIZATION AND MAPPING (SLAM) TO AID IN VISUALIZATION AND CONTROL OF A REMOTE PHYSICAL ROBOTIC PLATFORM

- 11:30 AM Esme Kemp, Governor's School for Science & Math  
PREDICTING STATISTICAL ATTRIBUTES OF A PROGRAM WITH TIMING ANALYSIS
- 11:45 AM Morgan Honaker, Governor's School for Science & Math  
THE DEVELOPMENT OF 3D MODELING IN LOST IN THE MIDDLE KINGDOM, A SECOND LANGUAGE ACQUISITION VIDEO GAME
- 12:00 PM Oscar Bezi, Governor's School for Science & Math  
CLOUD-BASED INTERPRETATION OF COMPILED LANGUAGES FOR ACCESSIBLE PROGRAMMING INSTRUCTION
- 12:15 PM Edward Kim, Governor's School for Science & Math  
THE DESIGN AND IMPLEMENTATION OF MINI-GAMES IN LOST IN THE MIDDLE KINGDOM: AN INTERACTIVE CHINESE-INSTRUCTIVE GAME
- 12:30 PM Lunch

**Math & Computer Science/Non-mentored**  
**Room 106 Alumni Hall**

- 1:30 PM Arif Siddiqi, Spring Valley High School  
COMPARATIVE ENCRYPTION/DECRYPTION TIMES AND ENCRYPTED MESSAGE SIZES OF AES, RABBIT, AND 3DES ENCRYPTION ALGORITHMS IN WEB BROWSE
- 1:45 PM William Edwards, Spring Valley High School  
A COMPARISON OF METAHEURISTIC ALGORITHMS FOR SCHOOL TIMETABLING
- 2:00 PM Greg Rassolov, Spring Valley High School  
THE CORRELATION BETWEEN RESOURCE USAGE AND REGENERATION AND POPULATION SIZE USING COMPUTATIONAL MODELING

**Microbiology/Mentored**  
**Room 316 Alumni Hall**

- 8:30 AM Zach Bradley, Governor's School for Science & Math  
CELL DEATH OF ESCHERICHIA COLI AND PSEUDOMONAS AERUGINOSA AS A RESULT OF EXPOSURE TO POLYVINYLPIRROLIDONE-COATED SILVER NANOPARTICLES
- 8:45 AM Aspasia Amiridis, Heathwood Hall Episcopal School  
SUPPRESSION OF HPV16 EXPRESSION IN HUMAN KERATINOCYTES BY SIRNA
- 9:00 AM Himabindu Vinnakota, Spring Valley High School  
THE EFFECTS OF SULFATE AND CARBOXYLATE NANOPARTICLES IN COMBINATION WITH PENICILLIN ON ANTIBIOTIC RESISTANT BACTERIA

**Microbiology/Non-mentored**  
**Room 316 Alumni Hall**

- 9:15 AM Cecelie Kondapaneni, Heathwood Hall Episcopal School  
INHIBITORY EFFECTS OF TURMERIC, THYME, CINNAMON, AND ACNE FACE  
TONER ON STAPHYLOCOCCUS EPIDERMIDIS
- 9:30 AM Katharine Hoffman, Heathwood Hall Episcopal School  
THE EFFICACY OF COPPER VERSUS STAINLESS STEEL IN REDUCING  
VIABLE BACTERIA ON SURFACES IN PUBLIC AREAS
- 9:45 AM Laura Hungiville, Heathwood Hall Episcopal School  
THE EFFECT OF THRUSH OFF™, THRUSH XX™ AND CLOROX® AS  
MEASURED BY THE ZONE OF INHIBITION OF FUSOBACTERIUM  
NECROPHORUM
- 10:00 AM Mary Royall Wilgis, Heathwood Hall Episcopal School  
THE EFFECT OF 300nm, 475nm, 650nm, AND 700nm WAVELENGTHS OF LIGHT  
ON THE GROWTH RATE OF SERRATIA LIQUEFACIENS
- 10:15 AM Break
- 10:30 AM Alexandra Andreen, Spring Valley High School  
THE EFFECT OF LIQUID PARAFFIN AND OLEA EUROPAEA L. ON THE  
GROWTH OF MICROCOCCUS LUTEUS
- 10:45 AM Nikitha Sashi, Spring Valley High School  
THE EFFECT OF RHIZOBIUM, PSEUDOMONAS FLUORESCENS, AND  
RHODOSPIRILLUM RUBRUM ON THE REMOVAL OF NITRATE FROM WATER
- 11:00 AM Sagarika Gami, Raghav Kappagantula and Nancy Kaura: Southside High School  
AN ANALYSIS ON THE EFFECT OF ANTIOXIDANT PROTECTION AGAINST  
ULTRAVIOLET RADIATION ON ESCHERICHIA COLI
- 11:15 AM Aryn Cooper, Spring Valley High School  
THE EFFECT OF COCONUT OIL ON THE GROWTH OF ASPERGILLUS NIGER  
AND RHIZOPUS STOLONIFER
- 11:30 AM Nikhila Cheepurupalli, Spring Valley High School  
THE EFFECT OF SALINITY LEVELS ON PLEUROTUS OSTREATUS LACCASE  
ACTIVITY AND REMOVAL OF PETROLEUM
- 11:45 AM Lunch
- 1:00 PM Yaxin Deng, Spring Valley High School  
THE EFFECT OF CARIA PAPAYA LINN. LEAF EXTRACT AND MEDICAL-  
GRADE HONEY ON ESCHERICHIA COLI K-12 BACTERIA CULTURE
- 1:15 PM Zachary Ariail, Spring Valley High School  
THE EFFECT OF CHITOSAN AND CHLORINE ON THE GROWTH OF SERRATIA  
MARCESCENS

- 1:30 PM Philip Richardson, Spring Valley High School  
THE EFFECT OF VARYING CONCENTRATIONS OF PEPTONE ON THE RATE OF BIOREMEDIATION USING PSEUDOMONAS FUORESCENS AND BACILLUS SUBTILIS
- 1:45 PM Linda Thomas, Spring Valley High School  
PHOTODYNAMIC THERAPY OF ESCHERICHIA COLI WITH THE USE OF HEMATOPORPHYRIN, PURPURIN, AND ALUMINUM PHTHALOCYANINE CHLORIDE AS PHOTSENSITIZERS
- 2:00 PM Liqi Zhao, Spring Valley High School  
THE EFFECT OF ANTIBACTERIAL MEDICATION ON THE RESISTANCE OF BIOFILM FORMATION AND EXTRACELLULAR POLYMERIC SUBSTANCES PRODUCED FROM STAPHYLOCOCCUS EPIDERMIDIS
- 2:15 PM Radhika Pandya, Harrison Stall, Adeline King and Patrick Misperita, Southside High School  
THE DIFFUSION OF BACILLUS SUBTILIS ACROSS NATURAL AND ARTIFICIAL FABRICS

**Physics/Mentored**  
**Room 316 Alumni Hall**

- 8:30 AM Carl Garris, Governor's School for Science & Math  
LASER SPECKLE TEMPORAL CONTRAST ANALYSIS AS AN IMAGING TECHNIQUE FOR BLOOD FLOW IN THE WEBBED FOOT OF A HYLIA CINEREA
- 8:45 AM Matthew Krumwiede, Governor's School for Science & Math  
ANALYZING THE DECAY OF THE HIGGS BOSON TO C-CBAR AND B-BBAR VIA JET RECONSTRUCTION ON A MONTE CARLO PARTICLE PHYSICS SIMULATOR
- 9:00 AM Chris Steele Governor's School for Science & Math  
DETERMINING FLUOROPHORE IDENTITY AND CONCENTRATION IN MIXED SOLUTIONS WITH LASER FLUORESCENCE SPECTROSCOPY

**Physics/Non- Mentored**  
**Room 106 Alumni Hall**

- 9:15 AM Aaron Harden, Heathwood Hall Episcopal School  
THE COMPARISON BETWEEN THE TEAR-STRENGTH OF RECYCLED AND NEW FABRICS
- 9:30 AM James Moninghoff, Spring Valley High School  
THE EFFECT OF A VARYING ANGLE OF ATTACK ON THE AERODYNAMICS OF A WING DESIGNED TO PRODUCE THRUST BY FLAPPING
- 9:45 AM Alexis Jones, Spring Valley High School  
THE TENSILE STRENGTH, THERMAL CONDUCTIVITY, AND ELECTRICAL CONDUCTIVITY, OF SPIDER SILK FROM ORB WEAVERS (NEPHILA CLAVIPES) AND GARDEN SPIDERS (ARANEUS DIADEMATUS)

10:00 AM James Eister, Seneca High School  
ALTERNATIVES TO "PUNKIN CHUNKIN" USING A PNEUMATIC PROJECTILE LAUNCHER

10:15 AM Break

**Physiology & Health/Non-mentored**  
**Room 110 Alumni Hall**

8:30 AM Jennifer Roth, Spring Valley High School  
THE EFFECT OF HEAD POSITIONS ON REDUCING SOCCER CONCUSSION RISK

8:45 AM Gadson Lefft, Heathwood Hall Episcopal School  
THE EFFECT OF CAFFEINE ON THE SPEED OF A MOUSE THROUGH A MAZE

9:00 AM James Mayson, Heathwood Hall Episcopal School  
THE EFFECT OF WHOLE MILK ON THE SURVIVABILITY OF SODIUM HYPOCHLORITE BY SACCHAROMYCES CEREVISIAE

9:15 AM Margaret Mullins & Ellie Barr, Heathwood Hall Episcopal School  
THE LEVEL OF ANTIOXIDANT PROPERTIES IN VITAMINS A, D, K, AND E AS MEASURED BY OXIDATION LEVELS IN APPLES

9:30 AM Payton Phillips & Brandon Hill, Heathwood Hall Episcopal School  
THE EFFECTS OF SLEEP DEPRIVATION ON REACTION TIME

9:45 AM Michaela Jenkins, Heathwood Hall Episcopal School  
THE EFFECT OF NATURAL LIGHT VERSUS ARTIFICIAL LIGHT ON TASK COMPLETION ACCURACY AND SPEED OF COMPLETION IN STUDENTS.

10:00 AM Break

10:15 AM Abigail Zvejnieks, Spring Valley High School  
THE EFFECT OF MEDICALLY DIRECTED DIET AND EXERCISE MODIFICATIONS ON THE RISK OF PRE-DIABETES AND TYPE 2 DIABETES

10:30 AM Charles Andrew Levitt, Spring Valley High School  
THE EFFECTS OF POLYURETHANE, PORON® PERFORMANCE URETHANE, AND FORCEBLOC POLYETHYLENE FOAM ON THE REDUCTION OF A SOCCER BALL'S IMPACT FORCE

10:45 AM Omar Abdeladl, Greenville Tech Charter School  
THE EFFICIENCY OF DIFFERENT PREPARATION METHODS OF MENISCA ALLOGRAFTS, PRE-MEDICAL TRANSPLANT

11:00 AM James Brewer, Spring Valley High School  
EFFECT OF DIFFERENT MUSICAL GENRES ON DIETARY DECISIONS OF HUMAN

11:15 AM Anna Beavers & Catherine Savoca, Heathwood Hall Episcopal School  
THE STUDY OF LEAD CONTENT EXTRACTED FROM HAIR WITH REGARDS TO DIFFERENT HAIR COLORS

**Physiology & Health/Mentored**  
**Room 216 Alumni Hall**

- 8:30 AM Ashani Ranwala, Governor's School for Science & Math  
S-GLUTATHIONYLATION OF BUCCAL CELL PROTEINS IN RESPONSE TO  
OXIDATIVE STRESS
- 8:45 AM Neal Patel, Governor's School for Science & Math  
NEURAL CORRELATES OF INCREASED AGGRESSION IN AN ANIMAL MODEL  
OF AUTISM
- 9:00 AM Sloan Miler Governor's School for Science & Math  
INTERLEUKIN-1 REGULATION OF RANK LIGAND EXPRESSION IN  
PREOSTEOBLAST CELLS
- 9:15 AM Toby Holden, Governor's School for Science & Math  
THE EFFECTS OF ANG-2 STIMULATION ON HUMAN BRAIN PERICYTE  
EXPRESSION OF PLATELET-DERIVED GROWTH FACTOR RECEPTOR-BETA
- 9:30 AM Zalak Shah, Governor's School for Science & Math  
GANODERIC ACID- DM INDUCES APOPTOSIS IN T CELL LYMPHOMA
- 9:45 AM Joy Jones, Governor's School for Science & Math  
REDUCTION OF ACETAMINOPHEN-INDUCED RENAL INJURY BY SRT1720
- 10:00 AM Break
- 10:15 AM Andrew Sedler, Governor's School for Science & Math  
AN ANALYSIS OF SCAPULAR POTTING TECHNIQUES USED IN A REVERSE  
TOTAL SHOULDER ARTHROPLASTY
- 10:30 AM Ana Nicole Lanier, Academic Magnet High School  
THE EFFECTS OF FCCP ON CALCIUM CHANNELS IN THE HEART
- 10:45 AM Cameron White Governor's School for Science & Math  
THE EFFECTS OF QUERCETIN ON SKELETAL MUSCLE PROTEIN  
DEGREDDATION AND OXIDATIVE CAPACITY IN MICE AFFLICTED WITH  
CHEMICALLY INDUCED CANCER CACHEXIA
- 11:00 AM Katy Koon, Governor's School for Science & Math  
QUANTITATIVE ANALYSIS OF IN VIVO FLUORESCENCE MICROSCOPY FOR  
DRUG DELIVERY STUDIES
- 11:15 AM Samuel McCauley, Governor's School for Science & Math  
MEASURE OF OPTICAL DENSITY FROM THE RELEASE OF CHLORHEXIDINE  
DIGLUCONATE FROM ANTIBACTERIAL-COATED PVC INTO PHOSPHATE-  
BUFFERED SALINE
- 11:30 AM Guillermo Pineda, Spring Valley High School  
THE EFFECT OF DIABETES, HYPERTENSION, AND DIABETES &  
HYPERTENSION ON LEFT ATRIAL SIZE



**Psychology & Sociology/Non-mentored**  
**Room 309 Alumni Hall**

- 8:30 AM Surabhi Poola, Spring Valley High School  
THE EFFECT OF VARIOUS SENSORY STIMULI ON THE EMOTIONAL  
RESPONSES OF KINDERGARTEN STUDENTS AS INTERPRETED THROUGH  
DRAWING ANALYSIS AND COLOR USAGE
- 8:45 AM Caroline Nassab, Heathwood Hall Episcopal School  
THE EFFECT OF COLOR ON PERCEIVED TASTE
- 9:00 AM Claire Hudson & Anne Plowden, Heathwood Hall Episcopal School  
THE EFFECT OF PAPER COLOR ON THE ABILITY TO MEMORIZE AND  
RECALL WORDS
- 9:15 AM Eric Baxley, Heathwood Hall Episcopal School  
THE EFFECT OF VARIATIONS OF A CHORD PROGRESSION IN A PIECE OF  
MUSIC ON THE PRODUCTIVITY/CONCENTRATION OF HUMAN BEINGS
- 9:30 AM Larissa Heslop, Heathwood Hall Episcopal School  
WHAT ARE THE EFFECTS OF BACKGROUND COLOR AND FACIAL  
SYMMETRY ON ATTRACTIVENESS
- 9:45 AM Lucas Clark & Casey Glick, Heathwood Hall Episcopal School  
THE EFFECT OF ATHLETIC PREFERENCE ON PERSONALITY TYPE  
ACCORDING TO THE MYERS-BRIGGS TEST
- 10:00 AM Break
- 10:15 AM Sydney Ellen & Katherine Evans, Heathwood Hall Episcopal School  
THE EFFECT OF MUSIC GENRE ON THE PERCENTAGE OF WORDS  
RECALLED ON A SHORT TERM MEMORY TASK
- 10:30 AM David Long, Spring Valley High School  
THE EFFECT OF PLAYING VIDEO GAMES ON THE COMPREHENSION OF  
NEW VOCABULARY
- 10:45 AM Bushra Islam, Spring Valley High School  
THE INFLUENCE OF SOCIAL NETWORKING ON TEENAGE DECISION-  
MAKING
- 11:00 AM David Hodge, Spring Valley High School  
AN ANALYSIS OF BEHAVIOR IN SIMULATED SLOT MACHINE GAMBLING
- 11:15 AM Sean English, Spring Valley High School  
A STUDY OF THE AVERAGE HIGH SCHOOL STUDENT'S ADVERSITY TO  
DONATING BLOOD

**Zoology/Mentored**  
**Room 105 Alumni Hall**

- 8:30 AM Alex Golden, Governor's School for Science & Math  
INCREASED DIVERSITY OF SMALL MAMMAL POPULATIONS IN  
MONOCULTURE EDGE HABITATS

8:45 AM Tara Brown Governor's School for Science & Math  
EFFECTS OF AN ARTIFICIAL COYOTE (CANIS LATRANS) PRESENCE ON  
RACCOON (PROCYON LOTOR) BEHAVIOR

9:00 AM Traci Cromwell Governor's School for Science & Math  
PAROMALOSTOMUM SPOT, N. SP. (TURBELLARIA, MACROSTOMIDA) FROM  
THE COAST OF NORTH CAROLINA, USA

**Zoology/Non-mentored**  
**Room 105 Alumni Hall**

9:15 AM Alison Beach, Heathwood Hall Episcopal School  
THE DEATH RATE OF THE AMERICAN COCKROACH NYMPH WHEN  
EXPOSED TO THE SURFACE TREATMENTS BAKING SODA, LYSOL SPRAY,  
AND DISH SOAP

**Zoology/Non-mentored**  
**Room 105 Alumni Hall**

9:30 AM Grayson Stribling, Heathwood Hall Episcopal School  
THE EFFECT OF HIGH SPIKED SALINITY LEVELS ON THE DEVELOPMENT  
RATE OF ARTEMIA SALINA

9:45 AM Meg Evans, Heathwood Hall Episcopal School  
THE EFFECT OF REMOVAL FROM ULTRAVIOLET LIGHT ON THE NUMBER  
OF DEAD ARTEMIA SALINA

10:00 AM Break

10:30 AM Sarah Buchanan & McKenna Savoca, Heathwood Hall Episcopal School  
THE EFFECT OF SALINITY ON THE BIOLUMINESCENCE OF MARINE  
PYROCYSTIS FUSIFORMIS DINOFLAGELLATES

10:45 AM Sophia Holt, Heathwood Hall Episcopal School  
HOW DO DIFFERENT FOODS AFFECT THE GROWTH OF MICE (RATTUS  
NORVEGICUS)?

11:00 AM Taylor Davant, Heathwood Hall Episcopal School  
THE EFFECT OF THE WIDTH AND COLOR OF THE ZEBRA STRIPE PATTERN  
ON THE ATTRACTION OF MUSCA DOMESTICA

11:15 AM Madison Pobis, Spring Valley High School  
THE EFFECT OF ENDOCRINE-DISRUPTING BISPHEENOL A ON THE SEX  
RATIO AND EPRODUCTION OF DROSOPHILA MELANOGASTER

11:15 AM Olivia Joslin, Hilton Head Island High School  
THE EFFECT OF FEEDING FORMULATED SUSTAINABLE MEALS ON THE  
GROWTH OF LITOPENAEUS VANNAMEI

**Regional Science Fair Winners Poster session: 9:45 AM – 11:45 AM**

Biological Science

Zachary Morgan, Greenville Tech Charter High School

THE SEARCH FOR NATURAL SUBSTANCES FOR THE INHIBITION OF THE  
AGGLUTINATING ACTIVITY OF LECTINS ON HUMAN ERYTHROCYTES

Consumer Science

Brianna Eberl, Homeschool

CANNED OR FROZEN CALORIES?

Environmental Science

Roshni Malde & Ankit Bilgi, Southside High School

THE PRODUCTION EFFICIENCY OF ETHANOL FROM CELLULOSIC COMPOUNDS

Math/Computer Science

Prateek Shah & Amil Merchant, Southside High School

A HANDS-ON APPROACH TO ANDROID

Math/Computer Science

Cannon Palms, Southside High School

SIMULATING THE ENERGY PRODUCTION OF A SOLAR PANEL

Microbiology

Rebecca Caughman, Batesburg-Leesville High School

WHICH SUBSTANCE IS BEST AT INHIBITING THE GROWTH OF E-COLI: ANTIBIOTIC  
MATERIALS OR ORGANIC COMPOUNDS?

Microbiology - Mentored

Abigail Tillman and Jesseca Kusher, Spartanburg Day School

EXAMINING THE ANTIBACTERIAL PROPERTIES OF GARLIC OIL, OREGANO OIL, AND  
GRAPE SEED OIL EXTRACTS ON MICROORGANISMS SIGNIFICANT TO WOMEN'S HEALTH

Physics

Jill Derrick, Batesburg-Leesville High School

HEAT TRANSFER IN WINDOWS

Physics

Rowan Crowley, Crowley Home School

DIRT CHEAP: THE POWER BENEATH YOUR FEET

Physiology & Health- Non-mentored

Roy James, Gilbert Middle School

WEATHERING BRAIN FREEZE

Psychology/Sociology – Mentored

Chad Erturk and Avi Borad, Spartanburg Day School

THE EFFECTS OF PRIMING ON IMPLICIT ASSOCIATIONS OF HOMOSEXUALITY

## SCJAS ABSTRACTS

### THE EFFICIENCY OF DIFFERENT PREPARATION METHODS FOR MENISCAL ALLOGRAFTS PRE-MENISCAL TRANSPLANT SURGERY

Omar A. Abdeladl  
Greenville Tech Charter High School

In the knee, there is a horseshoe-shaped piece of cartilage called a meniscus. The knee contains a lateral meniscus and a medial meniscus. They are two pads of cartilaginous tissue which serve to reduce friction in the knee joint between the lower leg (tibia) and the thigh (femur). When it undergoes high tensions or strong pressures combined with twists, it can be injured. In sports and orthopedics, people will sometimes refer to this injury as a “torn meniscus.” The most efficient way to treat or fix a meniscal injury is by performing arthroscopic surgery. This surgery allows doctors to sew the torn pieces together. However, in most cases, parts have to be removed. After a number of surgeries, the meniscus is too worn out or has too many pieces missing for any further repair to be done. Eventually, the meniscus should be removed. This procedure is called a meniscal allograft. Every year 1.3 million people around the world are recommended to undergo meniscal replacement surgery. People are apprehensive of these surgeries because they fear that the new meniscus will deteriorate or cause problems. These issues happen due to the fact that the meniscus has to be prepared and preserved before the surgery. The common methods of preparing a meniscus for surgery are freeze-drying, freezing, no preparation (fresh), or freezing in glycerin. The project aims to provide an extensive understanding of the preparation methods of the meniscus pre-meniscal transplant. Cow menisci are prepared using the different methods and impacted numerous times with different forces using a mechanism that was designed for this experiment. Observation under high zoom images is conducted to determine the most or least damaged meniscus sample. The overall objective is to provide further understanding of the qualities of meniscal preparation methods and help patients weigh all options when considering the surgery. The project also provides documented data that will help doctors and researchers in improving the preparation methods of menisci before this surgery.

### THE TREATMENT OF PLANTS WITH BORIC ACID FOR FIRE RETARDATION

Kristy Abd-El-Malak, Dustin Cai and Ramya Kappagantula  
Southside High School

One of the main natural disasters that occur throughout the world is forest fires which devastate the natural and civilian life. The usual way to stop this catastrophe is to pour water on the trees. However, the water proves to be mostly ineffective and not cost-efficient, and while water will eventually work, water only stops the problem rather than prevents it. Our project has 2 main objectives of trying to produce a substance that stops fire from spreading and applying this substance successfully to plants, attacking the fire at the source rather than just trying to lessen the damage.

In completing our project, we used the chemicals of Boric Acid, Sodium Tetraborate Decahydrate, and  $H_2O$  to develop a flame retardant solution. This solution gets its characteristics from the high temperature resistance of both of the substances and the hydration characteristic of Sodium Tetraborate Decahydrate. After creating this solution, we applied it to two different plants, *Juniperus Virginiana* and *Helix Hydras* to create the effect of a forest fire. The reason these plants were chosen because of their composition. *Helix Hydras*, or Ivy, have high water amounts in its leaves, while *Juniperus Virginiana*, or Juniper, contain high amounts of sap in its leaves and branches. This difference was presumed to create a different set of results and show the versatility of the flame retardant solution. After applying this solution to these plants, a flame was placed 1 inch away from the leaves of the plant and left there for five minutes, on each of the experimental and control plants, which were left naked. After the five minutes had elapsed, the damage was assessed. To test the resilience of the spray in more efficient terms, strips of paper measuring 25.4 cm long and split into 5 equal sections. 5 strips of paper were sprayed with the solution and 5 others were left plain. These strips were burned and the velocity of the flame was measured as the flame spread, which was used as a comparing point between the experimental and control groups.

As a result, we found that when the substance was applied, the velocity of the flame and the rate in which it spread did in fact decrease significantly to the point where the flame did not spread by itself in the experimental group. Moreover, when the substance was applied to plants, the same effect was seen, as the damage done to the plants was much less in the experimental group. The findings back up our hypothesis and show the effectiveness of the solution in attempting to prevent the spread of a fire.

## SUPPRESSION OF HPV16 EXPRESSION IN HUMAN KERATINOCYTES BY siRNA

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The purpose of this study is to explore the suppression of HPV16 in human keratinocytes by siRNA to try to understand the effect of siRNA on HPV-mediated cancer. This was done by introducing anti-E6 siRNA to cells that were transformed with HPV16 and then testing levels of E6, E7, Rb, and P53. The hypothesis was if the siRNA reduces E6 levels, then these cells will die off. The null hypothesis was that E6 is not necessary for growth; if the anti-E6 siRNA reduces E6 levels, the cells will grow at the same rate as the cells exposed to siRNA that does not target E6. Levels of E6 and E7 RNA were measured using a method called RT-PCR; levels of Rb and P53 protein were measured using a method called ELISA. siRNA, or short interfering RNA, is a small strand of RNA that can inhibit the expression of certain proteins. E6 and E7 are the two oncogenous proteins that mediate transformation by HPV16, the primary cause of cervical cancer. Rb and P53 are both tumor suppressor proteins; they are inhibited by E6 and E7. The results were that cells containing the anti-E6 siRNA exhibited an increase in E6 and E7 levels; levels of Rb and P53 were decreased. The conclusion is that the anti-E6 siRNA used was not sufficient to suppress E6 expression and might have stimulated the expression of E6. Other siRNA molecules, targeting different areas in the E6 sequence, and anti E7 siRNA will be used in future studies.

## THE EFFECT OF LIQUID PARAFFIN AND *OLEA EUROPAEA L.* ON THE GROWTH OF *MICROCOCCLUS LUTEUS*

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Dental plaque is a prevalent problem among canines and if left unattended can become expensive to treat. The purpose of this research was to find an inexpensive, nonabrasive way to protect canines against dental plaque buildup. It was hoped to be accomplished by using olive oil and liquid paraffin, or a mixture of both. It was hypothesized that the combination of liquid paraffin and olive oil would be most effective in the reduction of *Micrococcus luteus* growth. To test the effects of the oils, a preliminary study was performed in which the zone of inhibition was observed for distilled water, liquid paraffin, olive oil, and the olive oil/liquid paraffin combination. For the experiment, *Micrococcus luteus*, the bacteria used to simulate canine dental plaque, was subcultured into each well plate. The first test, the control, determined the growth of *Micrococcus luteus* with a treatment of distilled water. In the second test olive oil was used, the third liquid paraffin, and the fourth an equal combination of liquid paraffin and olive oil. Growth was measured using a SpectroVis unit to compare absorbance values. The analysis of variance (ANOVA) was used and showed a statistical difference between at least one group. The null hypothesis was rejected because  $F(3, 92) = 4.56, p < 0.05$ . A post-hoc tukey test determined the statistical difference fell between the olive oil v. control, and olive oil v. olive oil/liquid paraffin. Therefore, olive oil was the most effective of the solutions.

## THE EFFECT OF CHITOSAN AND CHLORINE ON THE GROWTH OF *SERRATIA MARCESCENS*

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There is a serious worldwide problem concerning the cleanliness of water, especially in third world countries. Almost one billion people do not have access to clean water. The purpose of this experiment was to test a natural antimicrobial agent that would lower the growth of bacteria in order to keep water free of bacteria. It was hypothesized that if different treatments of chitosan and chlorine were used as an antimicrobial agent, then the chitosan would inhibit the growth of bacteria more than the chlorine and three controls: an undiluted bleach control, an acetic acid solution control, and a blank control. Five treatments were applied to prepared plates. The plates were incubated for 24 hours at 37°C. A ruler was used to measure the diameter of the zones of inhibition. It was found that the chitosan had a positive, significant effect of the zone of inhibition,  $F(4,85) = 146.44, p < 0.001$ . Tukey test results found that the chitosan had a significant difference from the acetic acid control. It was also found that the chlorine had a significant effect on the zone of inhibition, with Tukey test results showing that the chlorine had a significant difference from the bleach control. However, the Tukey test revealed that the chitosan and chlorine had no significant difference in antimicrobial activity. Therefore, the study indicates that chitosan is just as effective as chlorine in killing bacteria.

## THE STUDY OF VIOLET AND NEAR INFRARED ABSORBING CHROMOPHORES FOR BIFUNCTIONAL DNA OLIGONUCLEOTIDES

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Bifunctional DNA oligonucleotides serve as templates for silver clusters and as complementary binding sites for target oligonucleotides. Binding of the silver cluster to the oligonucleotide causes absorbance of 400 nm, while hybridization with the complementary strand produces absorbance of about 720 nm, absorbance optimal for optical sensing due the lack of background absorbance in the near infrared region. It was hypothesized that the nucleotides in the bridge of the sensor strand would have an effect on the types and yield of chromophores formed, for the sequences T3AcosRT4 and T3AcosRC4, a pH of 7 would be optimal, and all experiments would follow Le Chatlier's Principle. All samples were prepared with 10 mM citrate or 10 mM borate buffers at different pH levels to determine ideal pH levels. Then spectra were collected with UV-Visible spectrophotometry for all experiments to determine the absorbances and concentrations of the oligonucleotide sensors and duplexes. Studies showed that the nucleotides in the bridge of the sensor strand did have an effect on the chromophores formed. However pH of 7 was optimal for T3AcosRT4 while a pH of 9 was optimal for T3AcosRC4. All experiments did follow Le Chatlier's Principle. Although it was speculated that hydrogen bonding may be significant in the binding of the two oligonucleotide strands that form a duplex, studies have shown that complementary binding can occur only in the presence of a cation such as sodium or calcium, which prevents formation of i-motif. Future works include observation of new double stranded oligonucleotides.

## THE EFFECTS OF NUTITIONAL IRON ON BIOFUEL ALGAE

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Iron is typically the limiting nutrient for algal growth in the Pacific Ocean. Chlorella and scenedesmus algae are being studied as sources of biofuels to replace petroleum-based fuels. This study strove to optimize the iron nutrient concentration to maximize the growth of biofuel algae when all other nutrient levels were held constant. Algae were grown in one-liter flasks with varying levels of iron and density measurements were regularly taken. Optical density levels were analyzed by spectrophotometer at a wavelength of 430 nanometers. At the end of the growth period fatty acid methyl esters (FAME) were extracted and a gas chromatograph was used to differentiate and measure their concentrations. Lipids within the algae are the substances that are ideal for manipulation in the production of biofuel. The optimal concentration of iron was found to be between 2.5 milligrams and 1.25 milligrams of chelated iron (FeEDTA) and between 32.5 and 16.3 milligrams of available iron ( $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ ).

## THE LEVEL OF ANTIOXIDANT PROPERTIES IN VITAMINS A, D, E, AND K AS MEASURED BY OXIDATION LEVELS IN APPLES

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The purpose of this project was to determine the level of antioxidant properties in vitamins A, D, K, and E as measured by the oxidation levels in apples using Red Delicious apples as the indicator. The hypothesis was that if apple slices submerged in solutions of the vitamins A, D, K, or E, then Vitamin E will be the best antioxidant and keep the apples from oxidizing. Five Red Delicious apples were purchased and tablets of vitamins A, D, K, and E were purchased. The vitamins were crushed up with a mortar and pestle and mixed with distilled water. Apple Slices were soaked in the solutions for five minutes and then left to oxidize for thirty minutes. Afterwards, pictures were taken of each slice and uploaded into ImageJ® software. This software was able to detect the percentage of brown pixels in each image; helping to determine which apple had oxidized the most. These steps were repeated for all five trials. A new apple was cut and a new solution was made for each trial. It was concluded that vitamin K had the highest antioxidant property because apples submerged in vitamin K solutions were left the least oxidized. The data was averaged and analyzed using an ANOVA: single factor test. The results were statistically significant. Therefore the null hypothesis was rejected.

## THE EFFECT OF RAIL AND JUMP CUP MATERIAL ON ANGLE OF PULLBACK OF A PENDULUM REQUIRED TO DISLodge A JUMP

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Knocking down a rail in a cross country or show jumping competition is a fault and will deduct four points from the rider's score, so it is important that all jumps used in the course are equal in stability. The purpose of this experiment is to determine

whether the material of the rail and the material of the jump cup of a horse jump affect the angle of pullback of a pendulum needed to dislodge the rail. This study is beneficial to riders that are training or in competition and to course designers concerned with making a fair course. The null hypothesis is that the minimum angle required to dislodge a jump will not be affected by the material of the rail or jump cup. For this investigation, a jump was set up with each different type of rail, rotted wood, wood, PVC clad wood, and PVC, each tested in two different sets of jump cups, metal and plastic. Each rail was knocked down by a pendulum, and the pendulum's angle was measured. The minimum angle required to knock down the rail was recorded and tested again. The results of this experiment show that different material of the rail and the jump cup affect the minimum angle of pullback required. The smaller the angle of pullback, the easier it is to dislodge the rail. PVC in metal cups had the smallest angle of pullback required to dislodge it. All of the rails in the metal cups were dislodged at smaller angles than in plastic cups. After running ANOVA and T-tests, it was found that the differences in the angle of pullback for each rail in different cups was statistically significant. Therefore,  $H_0$  was rejected, and the data failed to reject  $H_1$ .

#### THE EFFECT OF VARIATIONS OF A CHORD PROGRESSION IN A PIECE OF MUSIC ON THE PRODUCTIVITY/CONCENTRATION OF HUMAN BEINGS

Eric Baxley  
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The purpose of this experiment is to determine the effect of variations of a chord progression in a piece of music on the productivity/concentration of human beings. The majority of students have had trouble focusing on assignments from time to time. Some try different methods of enhancing their focus. One of the most common methods is listening to music while they are studying. For this experiment, each test subject first took test 1 without an audio file playing. Following this, each test subject took test 2, this time with an audio file playing, containing a specific chord progression. Time taken to complete test 1 & test 2 was measured. Accuracy of the answers for test 2 was compared to that of test 1 for each individual. The basic finding of this experiment was that there is not a prominent correlation between individual chord progressions being played during the test-taking process and improved test scores or times. An ANOVA test based on the percent change in scores produced an  $F$  value of 1.51085 and an  $F$  critical value of 7.28698. A single-variable ANOVA test based on the percent change in times produced an  $F$  value of 0.20115 and an  $F$  critical value of 7.28698. The data failed to reject the null hypothesis that if the chord progression of a piece of music is I-V-IV, there will not be a difference in the rate of productivity compared to other chord progressions.

#### THE EFFECT OF VARIOUS GROWING MEDIUMS IN A HYDROPONIC SYSTEM ON THE GROWTH OF WISCONSIN FAST PLANTS (*BRASSICA RAPA*).

Olivia Bell  
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For this experiment, the effectiveness of three growing mediums, Pro-Mix, Vermiculite, and Grow Rocks, were tested to see which growing medium produced the best overall result in a Wisconsin Fast Plant shown by the number of leaves on the plant, plant height, and number of days it took the plant to flower. The hypothesis stated the Pro-Mix growing medium will cause the plants to produce the greatest outcome compared to the Vermiculite, Grow Rocks, 50% Vermiculite- 50% Grow Rocks, 25% Vermiculite- 75% Grow Rocks, and 75% Vermiculite- 25% Grow Rocks, in height, leaf number, and lifespan. The null hypothesis was different growing mediums used in a hydroponic system for growing Wisconsin Fast Plants, produce no difference among the measured growth characteristics of the plants. The purpose of this experiment was to determine whether growing medium (by itself or combinations) produced the best overall result in Wisconsin Fast Plants shown by number of leaves on the plant, plant height, and the number of days it took the plant to flower. One trial of three seeds per pot was conducted, with 54 pots in all. Data were collected every three days for a total of 30 days. As hypothesized, the Pro-Mix growing medium produced the best plant because the plants in this group grew first, were the tallest and produced flowers earlier than other groups of Vermiculite, Grow Rocks, or the combinations of both. An ANOVA test showed that the 25% Vermiculite- 75% Grow Rocks was the only group with statistical significance.

#### CLOUD-BASED INTERPRETATION OF COMPILED LANGUAGES FOR ACCESSIBLE PROGRAMMING INSTRUCTION

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Services such as Kahn Academy and iTunes U, which provide free, educational video content to aid students in lecture form, are a step forward from the current state of computer science instruction, usually consisting of classroom lectures and perhaps supervised laboratory practice. However, these programs are deficient in providing computer science materials, focusing on fields such as biology, mathematics, and chemistry. In an effort to address this problem, the goal of the research is to propose a revolution, rather than an evolution of the traditional approach. This research describes the design and preliminary

implementation of a dynamic approach to computer programming instruction. The recent popularity of internet access in both home and school environments is exploited, as well as the widespread use of mobile devices, to make computer programming instruction both available and dynamic. The migration of a program simulator written in Python and Pygame to HTML5, CSS, and JavaScript was designed, taking advantage of the latest features implemented in HTML5 to place computer programming instruction on the web in an interactive, extensible simulation environment.

#### RECOMMENDATIONS TO IMPROVE AND ENHANCE THE TIRE SUBCLUSTER IN SOUTH CAROLINA

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The purpose of this project is to determine which activities would increase the productivity of the tire cluster in S.C- the fastest growing tire cluster in the U.S- consisting of Michelin, Continental, and Bridgestone. This recommendation process was facilitated by forming a series of broad questions according to preexisting data about the automotive cluster in South Carolina, and Michael Porter's cluster based theory. The broad questions were then broken down into a series of sub questions. The first question is, "Is there enough competition among the tire manufacturers in the industry?" The next question is "Are the relationships between the tire industries and technical colleges or universities strong enough?" The third question is "Are there enough Institutions for Collaboration (IFCs) or auxiliary businesses to make a well developed cluster?" This question was broken down into a series of sub-questions. For example, what kind of IFCs or Auxiliary businesses are already in the area, and could the nature of these relationships be strengthened somehow? Is there any specialized service for IFCs to fill in the cluster for the major manufacturers? Data was gathered mainly by emailing and calling students of Harvard Business School, heads of Technical Colleges and University Research programs like Clemson's CU-ICAR institution, and people within the three major tire manufacturers in the state: Bridgestone, Continental, and Michelin. Recommendations made include forgoing favorable government tax policies or one-off incentives, not dedicating excessive resources towards strengthening technical college/university ties with the workforce, and developing connections between the tire companies in the industry.

#### BAMBOO AS A CANDIDATE FOR CELLULOSIC ETHANOL PRODUCTION

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The long term impacts of fossil fuel consumption have proven to be irrevocably detrimental. The need to stop future damage has necessitated attempts at creating biofuel alternatives to gasoline. Thus, this project has two main objectives: to determine the efficacy of producing ethanol from various cellulosic compounds and to see if cellulosic ethanol is a viable alternative fuel when compared to gasoline. The experiment uses corn, beets, and bamboo as the three cellulosic compounds from which to derive ethanol and is subdivided into three parts: decomposition, fermentation and distillation, and measuring results.

In order to effectively decompose the three substances into glucose we applied a steam pretreatment using a pressure cooker. This process breaks down the bonds between the cellulose, lignin, and hemicellulose in order to aid in releasing beta-glucose, necessary for ethanol production. Afterwards, the pretreated compounds are mashed into a mushy composition in order to create more surface area for the addition of Cellulase, an enzyme that catalyzes cellulolysis. The introduction of Cellulase expedites the process of breaking down cellulose within the compounds into its base glucose components. After leaving the cellulose in for a period of 72 hours, the compounds successfully decomposed into beta-glucose.

Fermentation was accomplished by adding yeast to the decomposed compounds and waiting the allotted time of 24 hours for the yeast to activate. The yeast ferments carbohydrates in the compounds and yields dilute solutions of alcohol, specifically ethyl alcohol. After using a distillation apparatus, we extracted ethanol from each of the three cellulosic compounds and analyzed results.

#### EVALUATING $Fe^{2+}$ RELEASE BY THE MITOCHONDRIAL $Na^+/Ca^{2+}$ EXCHANGER

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Free radicals (FR) are extremely reactive molecules that have an unpaired electron. FRs can donate or accept an electron from another molecule turning that molecule into a FR. This causes a chain reaction of FR production. Left unchecked, FRs can induce a cell to undergo death via apoptosis or necrosis. Unbound ferrous ( $Fe^{2+}$ ) iron can donate an electron and is a major cause of FR production during a reperfusion event such as a heart attack, stroke, or organ transplantation. Mitochondrial  $Fe^{2+}$  is a major source of FR production during reperfusion events. Treatments aimed at inhibiting mitochondrial  $Fe^{2+}$  accumulation have proven successful in diminishing cell death after reperfusion injuries. Several known  $Fe^{2+}$  transporters have been identified to also transport  $Ca^{2+}$ . Here a known mitochondrial  $Ca^{2+}$  transporter ( $Na^+/Ca^{2+}$  exchanger) was examined for its ability to transport  $Fe^{2+}$  in the hopes of identifying a new target for reperfusion injury and a better understanding of cellular  $Fe^{2+}$  traffic. Isolated mouse mitochondria were loaded with  $Ca^{2+}$  or  $Fe^{2+}$  prior to the addition of  $Na^+$ . Mitochondrial



Ca<sup>2+</sup> and Fe<sup>2+</sup>efflux was determined through fluorescent readings of fluo-4 and calcein, respectively, using a plate reader. It was confirmed that Ca<sup>2+</sup> will leave the mitochondria when Na<sup>+</sup> is added and that this efflux is prevented by the Na<sup>+</sup>/Ca<sup>2+</sup> exchanger inhibitor CGP 37157 indicating the Ca<sup>2+</sup> is leaving through the exchanger. The introduction of Na<sup>+</sup> to mitochondria loaded with Fe<sup>2+</sup>, however, did not cause Fe<sup>2+</sup> to leave the mitochondria. Therefore it can be concluded that Fe<sup>2+</sup> does not leave the mitochondria through the Na<sup>+</sup>/Ca<sup>2+</sup> exchanger.

#### THE USE OF LARD IN THE PRODUCTION OF BIODEISELS

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Currently, the most common ingredients in fuels are non-renewable energy sources such as coal or petroleum. In addition to having detrimental effects on the environment, these fossil fuels are prone to being diminished within the foreseeable future, so the demand for efficient renewable energy sources is increasing. We have attempted to fill this demand by experimenting to find out the most efficient way to make biodiesel fuel out of leftover pig fat. By mixing samples of lard with three different types of alcohol and differing amounts of lye and testing the viscosity and energy released when combusted of each sample, we were able to determine that the most efficient biofuels can be made with methanol and about 1% of the mixture's mass of sodium hydroxide as catalyst. The fuels made which ethanol in them had also seemed to be viable. In short, we were able to discover a way to efficiently make biodiesel fuel out of lard and alcohol. Further research may lead to lard-based fuels surpassing non-renewable energy sources as the most common types of fuel. If this happens, the world will be able to carry on without worrying about running out of fuel or polluting the environment.

#### CELL DEATH OF *ESCHERICHIA COLI* AND *PSEUDOMONAS AERUGINOSA* AS A RESULT OF EXPOSURE TO POLYVINYLPIRROLIDONE-COATED SILVER NANOPARTICLES

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Nanotechnology is a rather new area of study in the world of science. A particle can be classified as a nanoparticle if it has one or more dimensions between 1 and 100 nanometers. Silver nanoparticles (Ag-NPs) are known to have antimicrobial properties. To further study these properties about which not much is known, we exposed separate solutions of *Escherichia coli* and *Pseudomonas aeruginosa* in moderately hard water to concentrations of Ag-NPs at 0µg/L, 1µg/L, 100µg/L and 1000µg/L and observed the optical density (OD) of the bacteria over time to determine the toxicity on the cells. The form of Ag-NPs that was tested was coated with polyvinylpyrrolidone (PVP). Different dilutions of each of the concentrations of Ag-NPs with the bacteria were plated and placed in an incubator to grow over several hours. Afterward, the number of colony forming units (CFUs) was counted for the various concentrations. Through the information gathered by measuring the OD of the bacteria exposed to the Ag-NPs and the number of CFUs counted from the plated bacteria, it can be concluded that PVP-coated Ag-NPs have a toxic effect on *E. coli* and *P. aeruginosa*.

#### EFFECT OF DIFFERENT MUSICAL GENRES ON DIETARY DECISIONS OF HUMANS

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Music has been found to have different effects on humans. Whether music is affecting a behavior consciously, music affects the decisions that humans make every day of their lives. (Sobal 2009) The purpose for doing this research was to determine what type or if any type of music can make dietary decisions more healthy decisions or even cause a person to eat less. It was hypothesized that as calmer music is played, test subjects would become more relaxed and not feel the need to eat fatty foods or much food at all. In the first part of the experiment, no music was played while students from the same group came up and chose either an Oreo cookie or a granola bar to eat. This was done until all students in the room had chosen what they wanted to eat. The same experimental process was concluded for each level of independent variable, except that there was each respective music playing in the background during the experimentation. The statistical analysis showed that there was not enough evidence to support the statement that music has an effect on the types of foods that people eat.

#### THE REMOVAL OF ARSENIC TRIOXIDE FROM AQUEOUS MEDIA USING VARIOUS FILTERING METHODS

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Elisabeth Brown

Protein supplementary drinks and powders have become increasingly popular in the exercise world – in a similar way, many fruit juices have become prevalent, especially among children. Water is very important to one's diet; tap water being a main source of hydration. Previous analyses have been performed on protein drinks, apple juice, and tap water finding the presence of toxic elements – arsenic being a very prevalent substance. Arsenic is a hazardous element that, if ingested, induces severe diseases affecting major body systems. The purpose of this experiment was to determine whether using different filtering

methods and varying aqueous media affected the amount of arsenic in a solution. It was hypothesized that varying the filters and aqueous media being filtered would affect the amount of arsenic trioxide being filtered out, and that the Brita water filter would be the most effective in filtering. Three solutions of half arsenic half tap water, half arsenic half protein drink, and half arsenic half apple juice were run through varying filters. The arsenic levels were measured before and after. A two-way ANOVA test was run on the data, showing a significant difference for arsenic levels and the type of aqueous media,  $F(2, 33) = 420.0$ ,  $p = 0.000$ . There was a significant difference for arsenic levels and the type of filtering method,  $F(2, 33) = 421.80$ ,  $p = 0.000$ . A significance was also found for the interaction between the two variables,  $F(4, 33) = 210.00$ ,  $p < 0.001$ . Paired t-tests were also performed on each set of data, to determine whether there was a difference between the efficiencies of the filters being used. There was no significant difference in the group using water as the main aqueous media,  $t(8) = 2.00$ ,  $p = 0.081$ . There were significant differences in the groups using protein powder supplements and apple juice as the main aqueous medias,  $t(8) = 3.10$ ,  $p = 0.015$ ,  $t(8) = 3.60$ ,  $p = 0.007$ , respectively. The first hypothesis was supported, showing that varying the filtering method and aqueous media being filtered affected amounts of arsenic being filtered. The second hypothesis was not supported, as the Brita filter did not perform the best in all three test groups.

#### EFFECTS OF AN ARTIFICIAL COYOTE (*CANIS LATRANS*) PRESENCE ON RACCOON (*PROCYON LOTOR*) BEHAVIOR

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Governor's School for Science and Mathematics

The mesopredator release hypothesis (MRH) states that a population decrease of an apex predator can lead to an increase in the number of smaller-bodied predators. If this relationship exists between coyotes (*Canis latrans*) and raccoons (*Procyon lotor*), then raccoons should recognize coyotes as a threat and therefore show more vigilant and hiding behaviors and less grooming behaviors when in the presence of an artificial coyote scent. This hypothesis was tested by recording the behavior of raccoons in a 10x10 foot enclosure with one of three scent treatments attached to a side panel. Treatments contained scent extracted from the scat of coyotes with a diet of either 50% raccoons, representing a high-risk situation, or no raccoons, representing a low-risk situation. The third treatment was a blank of chemically-made scent. The behavior of the raccoons was analyzed for variance in vigilance, hiding, and grooming behaviors between the treatments. No differences were found between treatment groups for vigilance or hiding behaviors. However, there was more grooming in the blank (no-risk) trials than in the two higher risk trials. These results may indicate that coyotes are not a significant enough predator of raccoons to disrupt most of their behavioral patterns. However, these results may be unique to raccoons and different results could be found for a different species of mesopredator. It is important to extensively study the validity of the MRH, because it could affect herbivores and vegetation which could potentially lead to an ecosystem collapse.

#### THE EFFECT OF SALINITY ON THE BIOLUMINESCENCE OF MARINE *PYROCYSTIS FUSIFORMIS* DINOFLLAGELLATES

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In this experiment, we tested the effects of salinity on the bioluminescence of marine Dinoflagellates (*Pyrocystis fusiformis*). Global warming may be altering the planetary system that regulates evaporation and precipitation and cycles fresh water around the globe. The salinity changes, due to global warming, were researched in order to find different salinities to test on the *Pyrocystis fusiformis*. The different salinities, that were changed in order to find the results, served as the independent variable. It was hypothesized that the largest salinity value of 37 ppt., was going to produce the highest bioluminescence rate, and the lowest bioluminescence 0 ppt., was going to produce the lowest bioluminescence rate. The salinity variables were 0 ppt., 10 ppt., 35 ppt., and 37 ppt. The salinity values were measured by the *Vernier Logger Pro* Salinity Sensor. After the experiment was conducted, it was found that 0 ppt. and 10 ppt. showed no signs of bioluminescence throughout the project. Meanwhile, the largest salinity, 37 ppt., showed the most signs of bioluminescence. Our hypothesis was correct because the higher salinities did produce a higher bioluminescence.

#### INFLUENCE OF PH ON BORON REJECTION THROUGH A FIVE-STAGE HOME REVERSE OSMOSIS SYSTEM

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With the World Health Organization regulating boron concentrations in drinking water to 0.5 mg/L, reverse osmosis (RO) systems are forced to act on exceeding measures to reduce these levels. While these systems have demonstrated extremely proficient salt rejection levels (>99%), they are relatively inefficient at the removal of boron species. The purpose of this experiment was to observe the efficiency and effects of pH modification on boron rejection rates through a five-stage home reverse osmosis system. It was hypothesized that, similar to industrial scale RO systems, the rejection of boron in a standard pH solution would be inadequate (40-78%), however with increasing alkalinity, permeate boron rejection levels would

increase. A RO system was obtained and modified for the purposes of the experiment. Solutions containing boron concentrations of 5 mg/L were formulated using H<sub>3</sub>BO<sub>3</sub> and the pH was modified to a desired level (7.5, 9.5, 11.5) using NaOH. After filtration the rejection rates of the respective levels of pH were found to be 92, 96, and >96%. The rejection rate of boron by this RO system at a normal pH was considerably higher than expected. Modification of the pH to 11 has unanimously shown to improve boron rejection rates to levels exceeding 98%. The hypothesis was partially supported in that rejection rates did increase with increasing pH, however the initial rejection rate at a normal pH (7.5) was greater than the expected values between 40-78%.

#### INTERFERON- $\gamma$ DEPENDENT DEVELOPMENT OF VITILIGO

Laura Campbell

Governor's School for Science and Mathematics

Vitiligo is an autoimmune disorder characterized by the appearance of white macules due to the progressive loss of melanocytes in the epidermis (skin). IFN- $\gamma$  is a cytokine that is secreted by active T cells in the immune system to fight intracellular and viral infection. It was found that double transgenic h3TA2 IFN- $\gamma$  sufficient mice spontaneously developed vitiligo that progressed with age, while double transgenic h3TA2 IFN- $\gamma$  deficient mice did not develop vitiligo. To verify the genotype of the mice, the tails of the mice were collected and digested to extract the DNA. The isolated DNA was amplified by PCR using specific primers for h3T, A2 and IFN- $\gamma$  genes. The genotypes of the mice were confirmed and the PCR product was analyzed by agarose gel electrophoresis. The mice were further used to analyze the T cell populations. In order to analyze the T cell population, the spleens of the h3TA2 IFN- $\gamma$  sufficient mice were harvested and their splenocytes were obtained. Analysis of the splenocytes revealed that the transgenic TCR was primarily expressed by CD3+CD4-CD8- double-negative (DN) T cells in h3TA2 mice. There arose a possibility that the tyrosinase specific transgenic T cells present in h3TA2 mice required IFN- $\gamma$  for their functionality and their potency to cause vitiligo. Genetic absence of IFN- $\gamma$  controlled the disease. Hence, it may be concluded that the development of vitiligo in h3TA2 mice is IFN- $\gamma$  dependent and independent of perforin and TNF- $\alpha$ , since perforin and TNF- $\alpha$  deficiency fail to control the disease.

#### CONCURRENT DELIVERY OF HYDROPHILIC PROTEIN AND LIPOPHILIC DRUG BY FACILELY PREPARED SELF-ASSEMBLED COLLOIDAL NANOPARTICLES

Hilda Chan

Governor's School for Science and Mathematics

Malignant cancer cells have been found to over-express the transferrin receptor on the plasma membrane. This is due to the cell's need for lots of iron to sustain high rates of replication. Using a mixture of transferrin proteins, pyridine-modified Polyhydroxyethylmethacrylate (pHEMA), and the anti-cancer drug Doxorubicin (DOX), a nanoparticle was created to target tumor cells more effectively than traditional cancer treatments. Images, sizes, the effectiveness in releasing the DOX of the nanoparticle were measured using the transmission electron microscope, dynamic light scattering microscope, and confocal fluorescent microscope. The use of transferrin as a protein was also compared to the use of Human Serum Albumin (HSA), another protein. It was hypothesized that transferrin-covered nanoparticles would be more effective than HSA-covered nanoparticles in reducing cancer cell viability. Results show that transferrin targeted cancer cells much more effectively than HSA and the size of a nanoparticle was about 300nm. It was concluded that transferrin is a viable targeting protein coat for nanoparticles but that the sizes of the nanoparticles were too large. Further research will focus on reducing the size of these nanoparticles in order to decrease the chances of rejection by the body.

#### THE EFFECTS OF HISTORIC AND CURRENT LAND USE ON STREAM GEOMORPHOLOGY AND HABITAT QUALITY IN THE PIEDMONT REGION NEAR GREENVILLE, SOUTH CAROLINA

Megan Chapman

Governor's School for Science and Mathematics

Both recent and historical land uses can affect present-day physical, chemical, and biological conditions of stream ecosystems. The Piedmont of South Carolina is one region that has undergone significant environmental changes over the past century, transitioning from a landscape dominated by cotton farming to modern agriculture and urban growth. The goal of our project was to examine how both current and historical land use has affected stream geomorphology and stream ecosystem quality in the Piedmont. To conduct our study, sediment samples were taken from 22 rural sites in the Saluda and Enoree River Basins near Greenville. The sediment was dried and sieved to calculate the grain size distribution at each site. Width and depth measurements were made to calculate incision, entrenchment, and a width-to-depth ratio at each site. Habitat quality was assessed using the QHEI, and a Spearman's correlation analysis was used to look for relationships between stream characteristics. Results indicate that overall, all sites were very poorly sorted (mean  $\Phi = 0.30$ ) and skewed toward larger

grain sizes (skewness = -0.88). Furthermore, mean grain size ( $\Phi$ ) and mean skewness were both significantly positively correlated with percent forest cover and significantly negatively correlated with percent pasture cover. Finally, entrenchment was significantly negatively correlated with the mean grain size ( $\Phi$ ). We conclude that the larger grain size distributions we found in more heavily pastured areas could be the result of the area's historical land use, whereby storm events have led to greater loss of fine sediments from these anthropogenically impacted streams.

#### THE EFFECT OF SALINITY LEVELS ON *PLEUROTUS OSTREATUS* LACCASE ACTIVITY AND REMOVAL OF PETROLEUM

Nikhila Cheepurupalli  
Spring Valley High School

The purpose of this experiment was to determine if *Pleurotus ostreatus* would be able to produce laccase activity and degrade petroleum hydrocarbons in various salinity levels. The hypothesis was that the *Pleurotus ostreatus* in brackish water would produce the least amount of oxygen compared to fresh and salt water. Cut paper was placed in oil and water with varying salinity levels for 24 hours. The paper soaked in water outlined each egg carton compartment, then the *Pleurotus ostreatus* mycelium was placed, and covered on top with a layer of paper soaked in oil. The *Pleurotus ostreatus* were kept in a 2.5-Gallon Ziploc bag and had oxygen readings taken over a two-day interval for each bag. The *Pleurotus ostreatus* was kept in a Ziploc bag for 4 weeks before they were released from the Ziploc bag. Using a General Linear Model ANOVA, with an alpha value of 0.05, the null hypothesis that O<sub>2</sub> readings and the salinity treatments had no significant difference was rejected,  $F(2,81)=19.97$ ,  $p<0.001$ . The null hypothesis that salinity treatment and the O<sub>2</sub> reading had no significant difference was rejected,  $F(16,81)=1.77$ ,  $p<0.049$ . The Scheffé post-hoc test indicated that the brackish water had a significant difference with both salt water and fresh water while fresh water did not have a significant difference with salt water. Therefore, the hypothesis that *Pleurotus ostreatus* in brackish water would produce the least amount of oxygen compared to fresh water and salt water was supported.

#### SYNTHESIS AND BIOLOGICAL EVALUATION OF POLYAMINOHYDROXAMIC ACID ON MCF-10A AND MCF-7

Rachel Chen  
Governor's School for Science and Mathematics

Polyaminohydroxamic acid (PAHA) was synthesized over the course of five weeks. PAHA is a histone deacetylase inhibitor, which prevents deacetylation. Histone deacetylase removes acetyl groups from lysine residues, neutralizing the positive charge of the histone protein and causing the chromatin around the histone to condense, preventing tumor suppressors from being expressed. Lysine is an amino acid, but it affects DNA because lysine residues are located on the amino-terminal tails of histone proteins, which make up nucleosomes, and nucleosomes along with DNA make up chromosomes. This compound was tested against the commercial cancer drug, Trichostatin A (TSA), using a Methylthiazol Tetrazolium cell proliferation assay. A normal breast cell line and cancerous breast cell line were tested with TSA and PAHA. TSA and PAHA were only cytotoxic against the cancer cells and did not harm healthy cells. HA-17 may not be therapeutically relevant for killing cancer cells, but may be used in inhibiting the enzyme to sensitize cancer cells to other therapies, such as chemotherapy or other commercialized cancer treatments. The concentration for the effectiveness of HA-17 was too high to be used solely to kill cancer cells in patients and requires further testing in combination with other drugs.

#### A CONTACTLESS HAND RECOGNITION SYSTEM BASED ON GEOMETRIC RATIOS

Richard Chen  
Spring Valley High School

The purpose of this experiment was to design and create a unique contactless hand recognition system, and to test its accuracy. Biometrics is a form of identification based on recognition of a person's physical features and is a relatively new, albeit fast-growing field. This system would compare the geometric ratios of finger lengths and widths, and palm width. It was hypothesized that the system would have an EER (equal error rate) of 2% or lower, and that there was a positive correlation between the FRR (false reject rate) and threshold and a negative correlation between the FAR (false accept rate) and threshold. A wood box was constructed to take the images of the hands, and hands were allowed to "float" freely and unrestrained due to the nature of the system. Forty-five people used this device to submit five images each of their right hand. Programs written in the MATLAB® programming environment were then run to obtain the appropriate ratios of each hand and subsequently compare these ratios at various thresholds. It was found that the equal error rate was 0.765% at the threshold of 0.4500. Using a correlation regression test on the data, it was shown that there was a positive correlation between FRR and threshold, and a negative one between FAR and threshold. Therefore, this research has demonstrated that this system is indeed accurate and suitable for further experimentation.

## THE EFFECT OF MAST CELL INHIBITION ON TUMOR RESPONSE TO 5-FU

Michelle Choe

Governor's School for Science and Mathematics

Colorectal cancer is the third leading cause of death from cancer. Most treatments are limited due to the toxic effects on the body. A popular cancer treatment drug, 5-Fluorouracil (5-FU), stops the growth of cancer cells by creating RNA and DNA. It works by interfering with cancer cell growth by blocking the enzyme called thymidylate synthase (TS) which is responsible for synthesizing thymidine that is required for DNA synthesis in actively growing cancer cells. 5-FU not only attacks the cancerous cells in the body but also targets all other actively growing cells causing the toxic side effects that come along with chemotherapy. In order to prevent the attack on non-cancerous cells combination drugs were tested to see if they reduced the amount of polyps while decreasing the side effects. The mouse model APC<sup>Min/+</sup> mice were used in the experiment. APC<sup>Min/+</sup> mice have a mutation in the adenomatous polyposis coli (APC) gene, which causes it to develop many polyps in the small intestine and a few in the colon. The mice were injected with a combination of 5-FU and cromolyn (a mast cell inhibitor). The second group of mice was injected with 5-FU alternated with cromolyn injections and then injected with cromolyn. The third group of mice were injected with PBS as a control group. The tumors were counted after the treatment periods. The combination of 5-FU and cromolyn had the same effects on tumors as 5-FU. The mice treated with just cromolyn developed mammary gland tumors. The data showed that a combination of 5-FU and cromolyn have the same effect compared to mice treated solely with 5-FU on tumor burden.

## THE EFFECT OF POWER SAVING MODES ON WINDOWS 7 LAPTOPS POWER DRAW

Logan Corn

Spring Valley High School

Laptops have been around for almost two decades. With rising energy costs many people are looking for ways to save money on energy bills. The purpose of this project was to find in which power mode did laptops draw the least amount of energy. The power modes are only found in laptops that have the Windows 7 operating system. It was hypothesized that these power modes would in fact change power draw. The power settings that were tested were off as the control, power saver and balanced power modes. To test power draw the Watts up Pro was used with a USB-to-USB-b to plug into a Compaq Presario computer with a program to record the data. The laptops which, were all Dell laptops, were plugged in to the Watts up Pro via a standard power adapter for the laptops. All laptops were plugged in to the same power adapter and then were logged into one by one to switch power modes except for the off power mode in which the laptops stayed closed and it was not necessary to log, but it was plugged in. To find how much power draw was actually taking place the battery was taken out to see power draw to the computer not how much energy was needed to replenish the battery. After running an ANOVA test at alpha=0.05, the null hypothesis was rejected,  $F(2,69)=831.86$ ,  $p<0.001$ . The Tukey test showed that off drew less power than the other two settings. When power saver was compared to balanced power saver was shown to save slightly more power.

## *PAROMALOSTOMUM SPOT*, N. SP. (TURBELLARIA, MACROSTOMIDA) FROM THE COAST OF NORTH CAROLINA, USA

Traci Cromwell

Governor's School for Science and Mathematics

The interstitial fauna of several coasts is relatively unexamined. The examination of this fauna is important, because it represents the health of the environment around it. If the specimens are thriving, then the environment is healthy. Several new species of Flatworm have been recently described. In this paper, we describe a new species of *Paromalostomum*, found on the coast of North Carolina. Distinguishing characteristics such as stylet lengths were used to differentiate this species from others previously described. Continued study is necessary to further describe other species of *Paromalostomum* which can be used to monitor the health of the faunal environments the specimens inhabit.

## DEPENDENCE STRUCTURE OF US STOCK MARKET IN VIEW OF LONG-RANGE CROSS-CORRELATION

William Damron

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This research was an attempt to understand the complex relationships within the New York Stock Exchange. An understanding of the relationships makes it possible to utilize pair trading methods and develop safer stock portfolios. The relationships were studied first by using Random Matrix Theory (RMT) and then using Network Analysis. Using RMT, a matrix containing data was compared to a random matrix to determine which trends were significant. Network Analysis produces similar results in a more visual form. The important trends were analyzed with respect to the different stock

industry groups to determine the causes. This showed that the most important trend corresponded with market-wide effects with varied causes such as political conditions, the general state of the economy, and public willingness to invest. The second largest trend showed a correlation between Oil and Gas, Basic Materials, Healthcare, and Utilities stocks as well as an anti-correlation with Consumer Services and Financial Stocks. The third largest trend showed a correlation between Oil and Gas and Real Estate and Financial Services as well as an anti-correlation with Healthcare, Consumer Services, Utilities, and Technology. These correlations and anti-correlations act as correcting factors, each having a smaller effect on the relationship.

#### DOES THE HEIGHT OF A TREE CORRELATE WITH ANY OTHER PHYSICAL CHARACTERISTICS OF THE TREE

Ayan Dasgupta  
Hammond High School

This study was undertaken to investigate whether the height of a tree had any correlation with any other physical characteristics like the height of the first branch, girth or the width of the green foliage in Loblolly pine trees. The study tried to answer the following questions:

- Was the total height of a tree directly proportional to the girth of the tree
- Was the height of first branch directly proportional to the total height of a tree
- Was the width of a tree's foliage at its widest point directly proportional to a tree's total height

In this project Loblolly pines were chosen from a mature pine forest where the pine trees were tall. Their height ranging from 15 meters to 21 meters. The trees at the edge of the forest along a road were photographed and measured starting from an arbitrary point. The photographs of the trees were used to measure their total height, width, height of the first branch and the width of the green foliage at the widest point. To validate the above method for calculating height and width, the height and width of a few trees was also calculated using the "yardstick", and "trigonometry" methods. The hypothesis was that the total height of a tree would be directly proportional to the girth of the tree, the height of the first branch would be directly proportional to the total height of a tree and the width of a tree's foliage at its widest point would be directly proportional to a tree's total height. A total of thirty five trees were studied. The results showed that the current study was unable to validate the hypotheses because for each comparison the r-squared value was not very big which resulted in the regression line explaining only a small percentage of the variation of the data. However, the study did find that there was strong correlation between the heights of the trees and their girths and the widths of foliage. There was moderate correlation, linear relation, between the heights of the trees and the heights of their first branch. This was shown by the r-value and a linear regression t-test.

#### WHICH INSECT REPELLENT IS MOST EFFECTIVE WHEN TRYING TO KEEP MOSQUITOES OUT OF A SCREENED IN AREA?

Donen Davis  
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The purpose of this study was to test the effectiveness of three different types of insect repellents (DEET, screen spray (picardin), and catnip extract) in regards to keeping mosquitoes out of a screened in area. In this study the type of repellent is what was manipulated and the percent of mosquitoes that end up inside the screened in box after six hours is what was measured. In order to test the effectiveness of these three repellents mosquitoes were placed inside a glass aquarium along with a six by six wooden frame covered with screen, each side, excluding the bottom (which was lined with double sided tape), had a 1.5 inches by 1.5 inches hole cut in it and inside this frame was the sole of an old shoe (to attract the mosquitoes). One of the three repellents was put on the screen and the frame was left in the aquarium for 6 hours. At the end of six hours the number of mosquitoes that were stuck to the bottom of the frame were counted and recorded. This was repeated twice for each repellent and twice with no repellent at all. DEET was found to be the most effective with an average of 15% of the mosquitoes entering the box in six hours, the catnip extract and the screen spray were equally effective both with around 35-40%, and the control (no repellent at all) was the least effective with an average of 62.5%.

#### UTILIZING POLYMERASE CHAIN REACTION AND AGAROSE GELS TO INVESTIGATE THE INTERACTION OF POTENTIAL CHROMIUM (III) ANTICANCER DRUGS WITH DNA

Hazel Davis  
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As a progressively larger number of individuals suffer from undesirable and often lethal side effects of anticancer treatments, a research field has emerged to investigate alternate and more efficient possibilities. One of the most widely used chemotherapeutic agents, cisplatin:  $[Pt(NH_3)_2Cl_2]$ , is a platinum centered drug that is unable to select between cancerous and

normal cells. Efforts are underway to discover a compound that has increased selectivity and therefore a lower degree of toxicity. Cr(III) complexes have the advantage of being photoactive and thus have a greater degree of selectivity than the cisplatin complex. Upon photoactivation at 350 nm, the Cr(III) complexes are thought to either intercalate with the DNA strands or form covalent adducts with the DNA bases. In order to study specific Cr(III) complexes and their interactions with DNA, gel electrophoresis as well as Polymerase Chain Reaction (PCR) were used. Gel electrophoresis experiments show the resulting electrophoretic mobility of compounds and their interaction with DNA. PCR experiments were further used to investigate the effects that the photoactivated Cr(III) complexes have in their interaction with plasmid vector DNA during the replication process. *rac*-[Cr(DPPZ)<sub>3</sub>]<sup>3+</sup>, *rac*-[Cr(tmp)(DPPZ)(1-meImid)<sub>2</sub>]<sup>3+</sup>, and *rac*-[Cr(phen)<sub>3</sub>]<sup>3+</sup> were utilized in this study to observe differing abilities of intercalation, DNA damage, and inhibition in the replication of DNA. This investigation attempts to understand the impact of photoactivated Cr(III) complexes on DNA and its systematic replication. Future studies will include experiments aimed to determine the locations at which the Cr(III) complexes bind to DNA, and how this can affect the nature of the interaction.

#### THE EFFECT OF *CARIA PAPAYA LINN.* LEAF EXTRACT AND MEDICAL-GRADE HONEY ON *ESCHERICHIA COLI* K-12 BACTERIA CULTURE

Yaxin Deng  
Spring Valley High School

The rapid development of civilization has caused not only the spread of bacteria, but also the prevalence of pathogenic and antibacterial-resistant bacteria. These types of bacteria pose great risk in developing countries and cause many deaths each year. This research was conducted to study the antibacterial of a mixed solution of Manuka Honey UMF 15+ and *Carica papaya linn.* leaf extract. Manuka honey is a clinically approved honey used for wound care and as an antibacterial agent. Papaya leaf extract have been discovered to be a potential antibacterial agent that can be employed for therapeutic use. It was hypothesized that Manuka honey and papaya leaf extract mixed solution will have greater activity against *Escherichia coli* K-12 than each of the solution individually. In order to support this hypothesis, two assessments were used: zone of inhibition and SpectroVis. The zone of inhibition was measured in millimeters after *Escherichia coli* K-12 was subcultured in to agar plate and incubated at 37°C for 24 hours. The SpectroVis assessment was conducted using eight 4x6 well plates that contained 1.5 mL of nutrient broth along with 1 mL of selected solution. F(5,64)=40.004, p<0.01, distilled water vs independent levels, F(5,64)=14.959, p<0.01, Manuka honey vs independent levels, F(5,63)=377.824, p<0.01 Papaya vs independent levels, and F(4,53)=11.78, p<0.01, the independent levels, therefore, there is enough evidence to support the hypothesis. However, based on the descriptive statistics, the Manuka Honey control had a higher antibacterial activity than the independent levels, thus, the hypothesis was only supported partially.

#### TRENDS IN POPULATIONS OF MICROGLIA IN THE DEVELOPING AUDITORY NERVE

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The microglia cell is a cell in the central nervous system that displays both immune and macrophage-like qualities. The microglia survey most of the brain and are activated by chemical signals. The basic functions of microglia in the nervous system are clear, but it has been discovered that microglia are also present among auditory nerves in the cochlear. Our hypothesis is that the microglia cells are located in large amounts during development of auditory nerves. To test our hypothesis, we collected samples from CBA/CAJ mice from 0, 3, 7, 14, and 21 days of post-natal development. Samples of the cochlea collected were stained using an ionized calcium binding adaptor molecule 1, otherwise known as the Iba-1, a protein expressed in microglia, even when they are activated. BrdU staining was also used to measure the proliferation cells. The Iba-1 tagged microglia cells and the BrdU tagged cells were then counted and recorded. Results showed a greater number of positive microglia cells in the samples from early stages of postnatal development, around the P4 to P7 time frame. In the future, we can determine the number of microglia cells in each sample and determine which days of development had the greatest peak of positive microglial cells.

#### AN ANALYSIS OF THE DETRIMENTAL EFFECTS OF IDLING A CAR ON VIOLA TRICOLOR

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For several decades, pollution has been an eminent problem. To stop it, people have looked towards organic foods and hybrids but ignore the pernicious effects of idling one's car. This project aims to determine if it bad to idle to cars. The project also specifically examines the effects of idling a car on the environment, specifically on *Viola tricolor*. The analysis operates under the assumption that nitrogen oxide, nitrogen dioxide, and volatile organic compounds react to form VOC's. The project includes two parts: an analysis of the car exhaust and a simulation of the effects of ozone on plants. Analysis of the car

exhaust was conducted at the Clemson University International Center for Automotive Research (CU ICAR). The Horiba MEXA – 584L was used to analyze the exhaust gases. We chose to use the NO<sub>x</sub> and volatile organic compound measurements because this project operates under the premise of NO<sub>x</sub> and volatile organic compounds combining to create ozone. Even though the volumes of the gases were not as large during idling as during acceleration, there were still significant amounts of volatile organic compounds and NO<sub>x</sub>, averaging 106 and 18 parts per million, respectively. To determine the effects of the exhaust gas on the environment, we exposed the plants to ozone. A Tesla coil was used to produce the ozone. The plants were exposed to the ozone for eight days, and we saw significant increases in leaf damage. We knew that there was ozone, because we used ozone indicator strips that changed color in response to exposure to the ozone. From the color change and a graph, we determined that there were around 120 to 160 parts per billion of ozone in the simulation.

We concluded that there were still significant amounts of NO<sub>x</sub> and volatile organic compound emissions when idling. The seemingly meager 106 and 18 parts per million add up, and can still cause damage when it is noted that 120 to 160 parts per billion of ozone causes significant damage in plants.

#### THE EFFECT OF VARIOUS ADDITIVES ON THE FREEZING POINT OF WATER FOR THE USE OF THE “LITER OF LIGHT” IN TEMPERATURES BELOW FREEZING

Meisha Draper  
Spring Valley High School

The purpose of this experiment is to see if there is a way to decrease the freezing temperature for a “Liter of Light” without decreasing the light intensity, for use of the “Liter of Light” in locations that often reach temperatures below freezing. It was hypothesized that salt would be the best way to lower the freezing point of the water, but the addition of this will decrease light intensity. Each bottle was filled with the same water to bleach ratio. The bottles were not completely filled to leave room for adding a substance. Each bottle had the same amount of added substance, with eight bottles for each of the four substances and eight more for the control. All of the bottles are recyclable plastic bottles of the same type. The substance added to the bottle was mixed in thoroughly, and the freezing point was calculated. The light source was aimed at each bottle at the same angle and the light intensity dispersed by the bottle was measured with a Vernier Light Sensor and a LabQuest 2. The results were that there was no significant difference between the light intensity of the different groups, but the freezing point decreased the most in the salt group. The hypothesis was not supported because there was no significant difference between the light intensities.

#### THE CREATION OF A STABLE NANOCOLLOID CONSISTING OF POLYMER BILAYER ENCAPSULATED NANOPARTICLES OF PACLITAXEL

Jason Eckert  
Governor’s School for Science and Mathematics

The aim of this research was to create nanoparticles of paclitaxel and encapsulate with two different polymers. We hypothesized that not only could the particles be formed, but that they would be more efficient than particles formed with other polymers. Paclitaxel (PTX) is an anti-cancer drug that has been proven effective to treat breast cancer, ovarian cancer, and Kaposi’s sarcoma. Because paclitaxel is a nonpolar molecule it has poor water solubility. This lack of solubility requires doctors to dissolve PTX in an organic solvent, most commonly methanol, before injecting it into the patient. Methanol is toxic, and can be fatal if injected into the body. Since the encapsulated nanoparticles do not aggregate in the body, there is no need for an organic solvent. This research used ultrasonication to break the particles of PTX down to nanoscale, and to promote the creation of the nanoparticle. Then encapsulated the particles with the bilayer polymer coating, and finally centrifuged to isolate the particles. The nanoparticles were analyzed to determine if size and charge are medically useful. This encapsulation method could be used to coat any poorly soluble negatively charged drugs.

#### ALTERNATIVES TO “PUNKIN CHUNKIN” USING A PNEUMATIC PROJECTILE LAUNCHER

James M. Eister  
Seneca High School

The purpose of this experiment was to test different fruits and vegetables (other than pumpkins) to determine which one would fly the farthest and fastest out of a pneumatic projectile launcher (PPL). It was hypothesized that the ripe potatoes would be the best thing to fire and would go the furthest with the greatest velocity. The procedure involved construction and testing of a PPL. It was constructed from 2, 1.5 feet of ½ inch PVC pipe, an air tight valve in the middle, and a bicycle tire valve at the end to pump air into. The PPL base was constructed so that the forty five degree angle with the horizontal that the PPL was placed at was held constant. Other constants included that the tank was pressurized at 70 psi before launching and the mass of the fruit remaining a constant 63 grams for the duration of the experiment. The experimentation involved launching a variety of fruit types and ages: ripe oranges, ripe potatoes, ripe tomatoes, rotten oranges, rotten potatoes, and



rotten tomatoes. Three of each kind of fruit were launched and the distance and time they traveled were recorded. Together, the values of time and distance were used in the equations:  $x = V_x t$  and  $y = V_y t + \frac{1}{2} a t^2$  to find the velocity at which the projectile was launched. It was found that the ripe potato traveled the furthest with an average distance of 71.5 meters and an average velocity of 26.8 m/s. It was also found that the least effective fruit to launch was the rotten tomato, traveling an average distance of 29 meters and an average velocity of 17.5 m/s.

#### A COMPARISON OF METAHEURISTIC ALGORITHMS FOR SCHOOL TIMETABLING

William Edwards  
Spring Valley High School

The purpose of this paper was to compare the performance of three algorithms applied to school timetabling, a complex problem with real-world consequences. The algorithms compared were genetic algorithm, simulated annealing, and a hybrid algorithm known as adaptive simulated annealing genetic algorithm (ASAGA). All three algorithms are metaheuristic, which means they continuously update a solution or group of solutions to improve over time. They are also Monte Carlo algorithms, which mean they incorporate randomness into their search of the solution space. It was hypothesized that ASAGA, which seeks to combine the advantages of genetic algorithms and simulated annealing, would produce the best outcomes. The algorithms were applied to thirty test problems, randomly generated based on probabilities from a real-world institution. An ANOVA test found that ASAGA consistently produced the best outcomes,  $F(2,2610) = 164.11$ ,  $p < 0.001$ , although it was considerably slower than the other two algorithms,  $F(2,2610) = 743.12$ ,  $p < 0.001$ . Since quality is more important than execution time for school timetabling, these results recommend ASAGA for further testing in the field.

#### THE EFFECT OF MUSIC GENRE ON THE PERCENTAGE OF WORDS RECALLED ON A SHORT TERM MEMORY TASK

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In this experiment, the effect of music genre on memory retention was examined. This information would be beneficial because it would heighten the awareness of the impact different music genres have on memory retention and insure that the benefit of using music while studying or memorizing is maximized. It was hypothesized that if a participant was asked to memorize and record a list of words with the presence of various music genres, then classical music would have the greatest percentage of correctly recorded words. This was accomplished by having twenty high school students memorize a list of words listening to classical music, rock music, pop music, and no music for two trials. The participant was given the first list of thirty words, and a timer was started while no music was playing. The timer was then stopped at two minutes, removing the list of words, and stopping the music. The timer was started again to allow the participant to sit with no music for one minute before recording all the words recalled. After the one-minute passed, the participant was given a blank sheet to record all the words he/she could recall from the previous list, and the timer was started for one minute. It was stopped at one minute and the sheet was removed. The percentage of correctly recorded words was recorded in a data table. The same participant repeated this process listening to rock music, pop music, then classical music. Each participant was tested twice (two trials). After all the data was collected, the data was averaged and percent changes between the control group (no music) and the music genres were identified using Microsoft *Excel*. Overall findings suggested that the average percent of correctly recalled words was not statistically significant; however, it was significant that rock music showed the greatest percent change in the amount of words recalled in comparison to the control, no music, at a six percent increase. Classical music showed a one percent decrease and Pop music showed a seven percent decrease in comparison to no music.

#### THE EFFECT OF PISTON STROKE AND BORE DIMENSIONS ON THE AMOUNT OF FORCE REQUIRED TO CREATE ENOUGH PRESSURE FOR REVERSE OSMOSIS

Mitchell England  
Spring Valley High School

This project was designed to determine what piston dimensions require the least input force to create pressure, and therefore would be the most efficient piston to aid in the Reverse Osmosis system. This experiment compares different sized pistons with the same working fluid volume and the force they require to create pressure. By minimizing the pressure required to pump water through a Reverse Osmosis (RO) system, less energy would be needed. It was hypothesized that a piston with a 5.08 cm bore would require less force to create pressure than a piston with a 10.16 cm bore. To test this, two pistons were built with the same working fluid volume of 62.8319 cm<sup>3</sup> but with different bores and strokes. Piston 1 had a stroke of 50.8 cm and a bore of 5.08 cm. Piston 2 had a bore of 10.16 cm and a stroke of 12.7 cm. They were connected to a RO system and filled

with a synthetic mixture of salt water. Force was then applied to each piston and the maximum force and pressure were recorded. A two sample *t*-test was conducted comparing the pressure values of Piston 1 and Piston 2, and another two sample *t*-test comparing the force values of the two pistons. The tests were run at an alpha value of 0.05. Piston 1 ( $M = 2.114$ ,  $SD = 0.303$ ) reported significantly higher pressure values than Piston 2 ( $M = 1.3560$ ,  $SD = 0.0875$ ),  $t(29) = 13.17$ ,  $p < .05$ . Piston 2 ( $M = 1150.5$ ,  $SD = 97.7$ ) reported significantly higher force values than Piston 1 ( $M = 495.8$ ,  $SD = 47.3$ ),  $t(29) = -33.05$ ,  $p < .05$ . The experiment concluded that Piston 1 would be more efficient and better for the RO system because it had higher-pressure values at lower forces.

#### A STUDY OF THE AVERAGE HIGH SCHOOL STUDENT'S ADVERSITY TO DONATING BLOOD

Sean English  
Spring Valley High School

Worldwide blood shortages have become an increasing problem each year, with about 22 million units of blood lost each year. Only about 5% of all eligible donors in developed countries donate blood. This has become a major problem, as there are many diseases that rely on blood transfusions for treatment. To ensure that blood donations will increase in the coming years, focus on the younger generation must become more prominent. Sixteen and seventeen-year-olds are eligible to donate with parental consent, hopefully ensuring that these young donors will become life-long repeat donors. Motivating these young adults to donate can be problematic, however. Surveys with information about the donation procedure, the destination of the donated blood, and the incentives given for the blood donation were handed out to teenagers at Spring Valley High School to find which motivates high school students to donate blood. Information-based surveys were hypothesized to influence high school students to donate blood, as most teenagers fear the donation process without knowing the actual procedure. A preliminary survey was sent out to a large population of students to find if any have previously donated. Once this information had been gathered, each survey was randomly assigned to the rest of the population; one third of the population receiving incentive based surveys, one third receiving blood destination surveys, and one third receiving blood donation process surveys. Results showed that teenagers are most influenced by learning of the donation procedure. 67% were influenced by Incentives, while only 56% were influenced by the knowledge of what donated blood does. Teenagers are overall, majorly influenced by learning about the blood donation process, most likely because they've never seen or heard how easy it is to donate blood.

#### SCREENING MIRNAS FOR THE GREATEST KNOCKDOWN ON THE KAINATE RECEPTOR SUBUNIT KA2

Jason Erno  
Spring Valley High School

There is an increasing problem regarding the 30-40% of people with epilepsy who cannot be treated with antiepileptic drugs. These people continue to seize everyday which can end in injury, depression, and death. The purpose of this study was to develop a new "tool" for better treatment of epilepsy through gene therapy in order to prevent seizures in refractory epileptics. It was hypothesized that miRNAs would bind to the mRNA to be destroyed and discontinue creating the kainate receptors and that differences would be apparent in effectiveness of various miRNAs. The method of conducting the experiment was to first transfect the KA2 and miRNA into the cells as DNA. The miRNAs to knockdown the KA2 were designated 849, 1256, 1753, and 2760. The cell lysates were then prepared for a Western Blot by washing the cells in PBS, pelleting in a centrifuge, adding RIPA buffer, extracting the supernatant, and conducting a Bradford Protein Assay. The Western Blot was conducted and ImageJ software was used to measure the optical densities of the bands from the Western Blot. The controls were dishes of HEK293 cells that only had KA2 and pcDNA added to them. Using a two sample *t*-test, it was found that the means of the dishes with miRNA were less than that of the controls,  $t(6) = 3.42$ ,  $p = 0.007$ . An ANOVA test also found that there was a significant difference among the different miRNAs,  $F(3,20) = 8.04$ ,  $p = 0.001$ . Through a post-hoc Tukey test, it was found that 1256 was significantly different from the other miRNAs and had a higher mean overall than the other miRNAs. This indicates that the miRNAs did have an effect on knocking down the amount of KA2 in a cell and 1256 appears to be the best at doing so.

#### THE EFFECTS OF PRIMING ON IMPLICIT ASSOCIATIONS OF HOMOSEXUALITY

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Associations of homosexuality and self-reported attitudes. The effect of priming on manipulation of implicit associations was also investigated. An implicit association is a cognitive relationship between two ideas (e.g., good and homosexuality) that operates without a person's intention or control. The Implicit Association Test (IAT) measures how strongly a person associates certain categories on an unconscious level. IAT is commonly used to identify a person's subconscious bias or possible bias he/she may not be willing to admit publicly. Our subjects received positive, control, and negative primes before

taking an IAT about homosexuality. Our results showed that priming influenced the implicit associations in the predicted direction, i.e. participants who received negative prime showed more negative associations whereas those who received positive primes showed more positive associations. We also observed that self-reported explicit attitudes were greatly underestimated when compared with the measured implicit association. Here we also report a negative correlation between the education level of the participants and antigay bias measured by the IAT (i.e., participants with lower education levels had the greatest amount of bias). Our research suggests that priming may influence people's attitudes. We also show that the participants either underestimated (i.e., self-deception) or under reported (i.e., other-deception) their degree of negative gay attitudes.

#### THE EFFECT OF REMOVAL FROM ULTRAVIOLET LIGHT ON THE NUMBER OF DEAD *ARTEMIA SALINA*

Margaret Scarborough Evans  
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For this investigation, brine shrimp were removed from ultraviolet light for one, two, and three days to see if there was an effect on the number of dead shrimp. *Artemia salina*, or commonly referred to as brine shrimp is a type of crustacean found all over the world in salt lakes. For the experiment, the independent variable was the ultraviolet light and the dependent variable was the number of dead brine shrimp. A F15T8 Ultraviolet bulb was used, which was a black light. The null hypothesis that was tested was: If brine shrimp are removed from the ultraviolet lighting for durations of one, two and three days, then the number of dead shrimp will be the same. The hypothesis that was tested was: If brine shrimp are removed from the ultraviolet lighting for durations of one, two, and three days, then the three day period of removal will have the greatest number of dead shrimp. A two-test proportions test was used to determine if there was any statistical difference between the groups. There was a statistical difference between the no removal and one day removal groups and the no removal and two day removal groups. Because the Z-value of the no removal and three day removal was less than 2, there was no statistical difference between these groups. The hypothesis was rejected and the null hypothesis was accepted.

#### THE EFFECT OF 5-FLUORO-2'-DEOXYURIDINE ON THE INCORPORATION OF OF 5-IODO-2'-DEOXYURIDINE IN DNA OF HT-29 CELL

Ya Fang  
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Colorectal cancer is the third most common cancer in the United States, responsible for the deaths of around 51,690 Americans in 2012. 5-fluorouracil (5-FU), a chemotherapeutic drug, has been clinically found to mediate colorectal tumors. The nucleoside analog of 5-FU, 5-fluoro-2'-deoxyuridine (FdUrd), is an anti-metabolite, which is a substance that can interfere with the function of a cell. In the case of FdUrd, it inhibits the protein thymidylate synthase (TS). In the absence of 5-FU, TS is used to produce thymidine monophosphate (dTMP), which then under goes a series of phosphorylations to produce thymidine triphosphate (dTTP), that is used in DNA synthesis. Because FdUrd hinders TS, it is able to upset the balance in the nucleotide pool and consequently kill the cell. The *HT29* cells in this experiment were treated with FdUrd for different durations, causing the cells to be deprived of thymidine. 5-iodo-2'-doxyuridine (IododU), served as a replacement substrate for the cells that are lacking thymidine. It is hypothesized that with a longer treatment of FdUrd, TS would be inhibited for a longer time, thus there would be more IododU observed in the DNA. The cells were lysed and strung out on microscope slides. The primary antibody, bromodeoxyuridine (BrdU), and secondary antibody, AlexaFluor 568, were then used to detect IododU. Because of the fluorescence molecule in AlexaFluor, IododU in the DNA were able to be observed after exposure to light. Using a florescence microscope, the slides were observed. It was concluded that the drug appeared to be interfering with lysing ability of cells. Further investigations of the effects of FdUrd would involve more treatments of FdUrd with longer time for IododU incubations.

#### INHIBITORY EFFECTS OF SODIUM DEOXYCHOLATE ON THE FIBRIL FORMATION OF AB PEPTIDES

Habiba Fayyaz  
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Alzheimer's disease (AD) is one of the most common forms of dementia and affects nearly 37 million people worldwide. The purpose of this experiment was to determine if sodium deoxycholate could effectively inhibit the aggregation of the  $\beta$ -amyloid ( $A\beta$ ) peptide, which is found aggregated in senile plaques in postmortem examinations of AD patients. It was hypothesized that using sodium deoxycholate as an additive would inhibit the aggregation of  $A\beta$  peptide. A stock solution of  $A\beta$  peptide in KOH was dissolved further in a PBS solution containing either no additive or 10 mM or 40 mM of sodium deoxycholate. After a ten day aggregation period, the peptide samples were measured for their absorbance at 405 nm. The samples were then mixed with a congo red solution and incubated before being measured for their absorbance again at 405 and 540 nm to determine the concentration of  $A\beta$  fibrils. At  $\alpha=0.05$ , the additive significantly inhibited the absorbance of the peptide samples

at 405 nm,  $F(2, 27)=21.35$ ,  $p<0.001$ . The control group was found to be significantly different from the 10 mM and 40 mM sodium deoxycholate groups. At  $\alpha=0.05$ , the additive significantly reduced the A $\beta$  fibril concentration,  $F(2, 27)=312.17$ ,  $p<0.001$ . The control group was found to be significantly different from the 10 mM and 40 mM sodium deoxycholate groups, and both concentrations were also found to be significantly different from each other. The hypothesis was supported because sodium deoxycholate did significantly inhibit the aggregation of A $\beta$  peptides.

#### THE EFFECT OF UV EXPOSURE ON THE MASS OF HIGH-DENSITY POLYETHYLENE, POLYETHYLENE TEREPHTHALATE, PROPYLENE, POLYSTYRENE, AND BIODEGRADABLE POLYLACTIC ACID BASED PLASTIC WHEN PLACED IN SIMULATED OCEAN WATER

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The purpose of the experiment was to test the change in mass when the high-density polyethylene, polyethylene terephthalate, propylene, polystyrene, and biodegradable polylactic acid based plastic were exposed to UV light and put into cups filled with salt water. This is due to heavy pollution that takes place in the Pacific Ocean, as currents carry the plastic to one spot on the planet, and can cause harm to the environment. It was hypothesized that polystyrene would degrade the fastest, and the high-density polyethylene would have the slowest degradation. Five different types of plastics were exposed to a UV light and salt water over 1000 hours. The masses of the plastic were measured daily, one plastic per day, using a highly accurate scale that could measure mass to three decimal places. The results in the experiment showed that the polystyrene had the most significant change, with a 20% increase in its mass, while the high density polyethylene had the smallest change, with only a  $3.45 \times 10^{-3}\%$  increase in mass. Therefore, the hypothesis should be refuted as the mass of the polystyrene increased. The mass of the high-density polyethylene did decrease the least. An ANOVA test was run on the polystyrene values found in each of the five weeks  $F(4,69)=43.64$ ,  $p<0.001$ . A scheffé post-hoc test was run. It was discovered that the largest value of the post hoc test was between the initial mass and the mass in the fifth week of testing.

#### THE CARCINOGENIC PROPERTIES OF TRICLOSAN AND ITS PHOTOLYTIC DERIVATIVES

Benjamin Fechter  
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5-chloro-(2,4-dichlorophenoxy)phenol, triclosan, is an effective antibacterial and antimicrobial agent utilized in household and consumer care products. It has been shown to break down in the presence of ultraviolet light, and the resultant products are suspected to be carcinogenic in nature. In this experiment, triclosan was exposed to high levels of UV light in order to observe the carcinogenic properties of the chemical and its photolytic derivatives. It was predicted that an increase in ultraviolet radiation would correspond to increasingly carcinogenic chemical derivations. Experimentation was accomplished by exposing solutions of 5-chloro-(2,4- dichlorophenoxy)phenol (methyl triclosan) to high intensity UV light for 0, 15, 30, 60, and 120 minute periods. *Drosophila melanogaster* were used as the model for this experiment. A group of 40 flies was exposed to fly media created with non-irradiated triclosan to serve as a control, and identical sample groups were exposed to fly media created with triclosan which had been irradiated in 15, 30, 60, and 120 minutes periods. Mature flies were removed, counted, observed and massed every 2 weeks over a 6 week period. The hypothesis that increased irradiation would correspond to higher mutation levels was neither supported nor rejected. At  $\alpha = 0.05$ , increasingly irradiated triclosan doped media corresponded to significantly lower mass,  $F(4,14) = 7.85$ ,  $p = 0.007$ . Growth was substantially stifled in the sample group exposed to triclosan irradiated for 60 and 120 minutes. In conclusion, highly irradiated triclosan appears to hamper growth and increase number of offspring in *D. melanogaster*.

#### THE EFFECT OF WASHING HYDROCHAR ON THE ADSORPTION OF ATRAZINE SOLUTION

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The purpose of this study was to evaluate the effect of acetone washing hydrochar after hydrothermal carbonization (HTC) on the adsorptive capacity for atrazine. HTC is a process through which wastes and biomass are heated in water at temperatures ranging from 150-350°C under autogeneous pressures and converted into a carbonaceous residue called hydrochar. It was hypothesized that washing the hydrochar will enhance adsorptive capacity of food waste hydrochar for atrazine. The adsorptive capacities of the washed and unwashed hydrochars were compared using a Freundlich isotherm. Using a generalized linear model, it was shown that the adsorptive capacity of the washed hydrochar was statistically significantly higher than that of the unwashed hydrochar using a significance level of 95% ( $p<0.05$ ).  $^{13}\text{C}$  solid-state NMR results showed a decrease in alkyl groups and an increase in aromatic/olefinic-C groups.  $^1\text{H}$  liquid-phase NMR results showed that carbon alkyl chains were removed during acetone washing. Interaction energies calculated using molecular modeling show that atrazine is

more strongly adsorbed to surfaces without weakly associated alkyl groups and support the observation that adsorptive capacity of washed hydrochar is higher than that of unwashed hydrochar, which supports the original hypothesis.

PREVENTION OF EUTROPHICATION: REMOVING EXCESS AMMONIA FROM WATER USING FLY ASH, NA-4-MICA,  
AND FANWORT (*CABOMBA CAROLINIANA*)

Meghan Franco  
Spring Valley High School

Eutrophication is the over enrichment of nutrients and is associated with the discharge of nitrogen and phosphorus into an aquatic ecosystem. Due to growing population growth and economic development, there has been an increase in nutrient-rich runoff that can contaminate water sources and lead to algae blooms. This is important because decreasing the amount of nutrients in water would decrease the number of algae blooms and therefore, decrease fish kills. It was hypothesized that using Na-4-mica would more effectively remove ammonia from water when compared to *Cabomba caroliniana* or fly ash. This investigation was accomplished by having various combinations of batch amendments, which were fly ash, Na-4-mica, fanwort, fly ash and Na-4-mica, fly ash and fanwort, Na-4-mica and fanwort, and fly ash, Na-4-mica, and fanwort. Ammonia was passed through each filter and the amount of ammonia present in the filtered water was measured using a HACH© Ammonia test kit. The hypothesis, which stated that Na-4-mica would be the most effective in absorbing ammonium hydroxide from solution, was rejected. An ANOVA test was run at a 95% confidence level ( $\alpha = 0.05$ ) and  $F(6, 28) = 3.53$ ,  $p < 0.0001$ . A Tukey post-hoc test indicated there was a statistically significant difference between group all groups except 1 vs. 4, 1 vs. 6, 2 vs. 4, 2 vs. 7, 3 vs. 5, 3 vs. 6, and 4 vs. 7 ( $p < 0.001$ ). The results of the experiment concluded that the combination of fly ash and fanwort was the most effective in removing ammonium hydroxide from solution.

PIEZOELECTRIC WAFER ACTIVE SENSOR (PWAS) BASED STRUCTURAL HEALTH MONITORING (SHM) ON GLASS  
FIBER REINFORCED POLYMER (GFRP)

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Structural health monitoring has been a process that requires expensive, heavy equipment that are unattached, narrowband resonators and cause in plane stress on the structure through "tapping." Piezoelectric Active Wafer Sensors (PWAS) based SHM is an emerging technology that operates on the piezoelectric principle by converting mechanical to electric energy and vice versa to create and receive signals that can be read to detect damage. PWAS are in plane wave exciters, resonate at a wideband of frequencies, and bond to the structure. The signals produced by PWAS can be analyzed to determine the location of damage within the structure through various methods. In this paper, PWAS were installed onto GFRP specimen. Three methods were conducted on specimens for damage detection. The first method was wave propagation on four specimens. Three specimens were cut with the fiber directions running at 45°, 0°, and 90°. Another specimen was cut with the fiber direction running at 45° and a hole. The experiment showed the characteristics within a structure affect the signal. Next the electromechanical impedance method was used. A 45° GFRP specimen with a hole was prepared for a tension test. The tension of the specimen can change the impedance of the structure which reflects on the valleys and peaks of the real part of impedance spectrum. The imaginary part of impedance can be used for sensor self-diagnostics. Finally, the tuning curve of velocity and attenuation on a structure in all directions were conducted. It revealed that the velocity and attenuation changes at different directions.

AN ANALYSIS ON THE EFFECT OF ANTIOXIDANT PROTECTION AGAINST ULTRAVIOLET RADIATION ON  
*ESCHERICHIA COLI*

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With awareness about the negative effects of UV radiation constantly increasing, natural compounds, such as antioxidants, have been proven to be effective for photoprotection. However, two of the most abundantly used antioxidants, vitamin E and C have not been thoroughly tested or studied to understand whether they can actively be used to maximize photoprotection. Thus, our experiment observes the effectiveness of vitamin E, vitamin C, and a combination of vitamins E and C on the growth of *E. Coli* while exposed to UV radiation. The *E. Coli* was incorporated into solutions where the antioxidants were mixed with a nutrient growth ingredient, and was grown for 24 hours before being exposed to any UV radiation. Then, the *E. Coli* was exposed to UV radiation for 0, 5, and 10 minutes, and was placed in an incubator at 37° C for 48 hours, after which, the amount of *E. Coli* colonies grown were counted and analyzed. Our trials showed that the combination of vitamins E and C was the most effective at preventing UV damage, however our data did not give us sufficient evidence to prove that the antioxidants had a large enough impact on protecting *E. Coli* growth. Our results confirm the fact that antioxidants can be

used as protectants against UV radiation, but suggest for more research and experimentation into creating combinations of antioxidants for UV protection. However, no resolute conclusion could be made from our experiment.

LASER SPECKLE TEMPORAL CONTRAST ANALYSIS AS AN IMAGING TECHNIQUE FOR BLOOD FLOW IN THE  
WEBBED FOOT OF A HYLIA CINEREA

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Laser Speckle Temporal Contrast Analysis was used to image the morphological structure of blood vessels in the webbed foot of an American Green Frog. A four-f optical setup was used in order to achieve the maximum balance between the scope and the resolution of the image. Preliminary tests were run using a CCD reception sensor and analyzed using ImageJ software. The method of analysis used to achieve the temporal contrast consisted of dividing the standard deviation of the images by the average of the images. The final setup used a CMOS camera as well as a new method of analysis in which the standard deviation of the first derivative of the images was divided by the average of the images. This new method yielded much clearer images than were revealed by the original method, showing the relative intensities and structure of both major and minor vessels. Future study will hopefully reveal more accurate methods by which to determine the optimal distance between the laser and the platform containing the frog.

THE CREATION OF HOST-GUEST COMPLEXES OF NAPHTHALENE-DIOL CO-CRYSTALLIZED IN CONJUNCTION  
WITH GUEST MOLECULES FOR COMPARISON WITH  $\alpha$ -CYCLODEXTRIN

Menshian George

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This research aimed to test the diversity of co-crystal structures of a naphthalene-diol 1 with guest molecules. These varied structures may prove comparable to  $\alpha$ -cyclodextrin in their uses due to their similarities. For instance, they both have similarly sized cavities with 6 hydroxyl groups arranged towards the center of the pore, which allows for easy bonding. These compounds are helpful because they tend to make the guests more soluble and thus easier to use commercially. One use of cyclodextrin is in the popular chemical product Febreze, but they are also widely used in drug delivery, stabilization of photosensitive substances, fixation of volatile substances, modification of liquid substances to powder, and protection against degradation of substances by microorganisms. Theoretically, the similarities between cyclodextrin and our compound will allow for mimicry. The molecule was synthesized using a one-step condensation reaction of 2-amine-4-tert-amylphenol and 1,4,5,8-naphthalene-tetracarboxylic dianhydride, which then assembled to form porous crystals. A variety of crystallization techniques were employed to ascertain whether the stability would remain constant with different guests. Preliminary results indicated that using Methanol as a guest molecule gave a stable crystal structure. In order to definitively categorize this nature of crystal, x-ray crystallography will be performed to show how well the Methanol was fixated.

A COMPARISON OF THE ABILITY OF SILICA-BASED AEROGEL, UV RADIATION EXPOSURE, DISTILLATION, AND  
SAND FILTRATION TO REMOVE IBUPROFEN FROM WATER

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The purpose of this experiment was to determine which method of removal of pharmaceuticals is the most efficient. This is important because a harmful amount of these drugs can be found in common water sources, and currently there is no efficient and cost-effective way to remove these drugs. It was hypothesized that distillation would reduce the concentration of pharmaceuticals more than that of sand filtration, silica-based aerogel, and UV radiation exposure. It was also hypothesized that silica-based aerogel would reduce the concentration of pharmaceuticals more than that of sand filtration and UV radiation exposure. Testing consisted of dissolving ibuprofen into water, performing the different methods of removal of pharmaceuticals on different batches of solutions, and then performing a titration of the remaining solution to find out how much of the pharmaceutical remained. Each method was tested 30 times, and there was a control of distilled water with no pharmaceuticals in it. Based on the one-way ANOVA test, there was a significant difference between at least one of the methods of filtration used ( $P < \alpha$ ). The Tukey Post-Hoc test indicated that there was a significant difference between silica-based aerogel and sand filtration, distillation, and UV radiation. The hypothesis that silica-based aerogel would reduce the concentration of pharmaceuticals more than that of sand filtration and UV radiation exposure was supported, but the hypothesis that distillation would remove more ibuprofen than any other method was not supported.

EVALUATION OF ANTIOXIDANT, PHENOLIC AND ANTHOCYANIN CONTENT IN  
PEACHES [*PRUNUS PERSICA* (L.) BATSCH]

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Fruit quality and nutritional content in flesh of four different varieties, 'Carored,' 'Caroking,' 'Juneprince' and 'Rubyprince', grown at Titan Farms in South Carolina, has been evaluated. Fruit quality was measured and analyzed in four different components, fruit firmness, diameter, weight, soluble solids content, and DA value (measurement of chlorophyll). Fruit quality analysis revealed significant differences in fruit diameter, weight, SSC% and firmness. Fruit diameter ranged from 57.2mm to 64.7mm with the highest measured in 'Caroking'. Fruit weight ranged from 106.8g to 166.5g with the highest measured in 'Caroking'. SCC% ranged from 8.9% to 10.4% with the highest measured in 'Juneprince'. Firmness ranged from 2.5kg to 2.7kg with the highest measured in 'Carored'. Phytochemical composition analysis revealed significant differences between analyzed varieties in total phenolics, antioxidant activity, and anthocyanin content. Total phenolics ranged from 19.7mg/g to 40.5mg/g with the highest content observed in 'Juneprince'. The highest antioxidant activity, 296.9µg/g, was observed in 'Juneprince' and the highest anthocyanin content in 'Caroking', 32.6mg/g. When phytochemical composition was assessed in the fruit from single variety, 'Carored', harvested from different fields, a significant difference was observed in the antioxidant activity, total phenolics and anthocyanin content.. Marker analysis performed on fourteen varieties grown at Titan Farms along with phytochemical data will support discovery of markers associated with nutritional content in peach fruit via association study.

THE EFFECT OF ATHLETIC PREFERENCE ON PERSONALITY TYPE ACCORDING TO THE MYERS-BRIGGS TEST

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The purpose of this experiment was to test the effect of athletic preference on personality type, using the Myers-Briggs test. Seventy-six participants were given the Myers-Briggs test to determine their four-part personality type. Thirty of the athletes were either team sport or individual sport athletes and sixteen of them were nonathletes. The Myers-Briggs test had seventy-two questions about their hobbies, interest, etc. to help determine what personality type, out of sixteen possible combinations, they were. It was hypothesized that team athletes would tend to be extraverted, and individual sport athletes would tend to be more introverted. The nonathletes would be more intuitive than the other two athletic groups. After recording the results, it was concluded that team sport athletes were primarily extroverted. This result was the same for the individual sport athletes as well. Both team sport athletes and individual sport athletes mainly had the ESFJ personality type. Nonathletes were mainly intuitive, and they were much more intuitive than the other two groups. These results proved that the team sport athletes were primarily extroverted, but it rejected the hypothesis that the individual sport athletes would be more introverted. They actually had more extroverted personality types. The nonathletes proved what was hypothesized, which was that they were more intuitive than the other two groups.

INCREASED DIVERSITY OF SMALL MAMMAL POPULATIONS IN MONOCULTURE EDGE HABITATS

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Small mammals are important links in local ecosystems. They fulfill important ecological roles such as seed dispersal, soil aeration, and nutrient recycling. Their short life spans make studying population changes easy, and the state of small mammal diversity serves as an index for the populations of other species in the ecosystem. This project sought to uncover differences between small mammal diversity in different habitats. For this experiment, plots in the Clemson Experimental Forest were chosen to represent four habitat types: stream, monoculture edge, vernal pool, and mixed forest. Small mammals were live trapped during six weeks in June and July of 2012. Individuals were marked with ear tags and released. Data on the species collected at each plot, and the ratio of marked to unmarked animals, was used to determine species diversity and dominant species at each habitat type. Results indicate proximity to water has little influence on diversity, and that the edge habitat has the highest level of diversity.

## DEVELOPMENT OF LAPAROSCOPIC SIMULATOR FOR SURGICAL SKILL ASSESSMENT

Michael Gray

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The use of laparoscopic surgery has strongly influenced the way that surgeries are conducted today; by creating small incisions (0.5-1.5cm), the surgeon can then insert a laparoscope into the patient and look inside. Because of minimal scarring and quick recovery times, this procedure is preferable to open surgery. The problem with laparoscopic surgery is that you need to know what you are looking at in order for the surgery to be efficient. The aim of this project is to create a laparoscopic model that simulates the conditions within the human body, so to eliminate the use of live subjects used for practice. In addition to making the model closely simulate the conditions of the body, we also aim to make the model versatile. A versatile model would allow for practice of several procedures as well as development of new technologies. The model is designed to simulate the abdominal cavity on a human after being inflated with carbon dioxide. Once the model was constructed, we conducted trial procedures of two separate natures. After collecting data from the practice procedures we worked to improve the design of the model and we hope to continue to experiment with not only laparoscopic procedures but some catheter work. Moving forward with the project, the goal is to improve the model so that we will be able to practice procedures accurately, as well as test experimental devices without any threat to live subjects.

## SYNTHESIS, STRUCTURES, AND OPTICAL PROPERTIES $\text{Na}_5\text{Ln}_4\text{Ge}_4\text{O}_{16}(\text{OH})$ , $\text{NaLnGeO}_4$ , AND $\text{LnO}(\text{OH})$ ( $\text{Ln}=\text{Sm}, \text{Eu}, \text{Gd}$ )

John Hardaway

Governor's School for Science and Mathematics

The synthesis of  $\text{Na}_5\text{Ln}_4\text{Ge}_4\text{O}_{16}(\text{OH})$ ,  $\text{NaLnGeO}_4$ , and  $\text{LnO}(\text{OH})$  ( $\text{Ln}=\text{Sm}, \text{Eu}, \text{Gd}$ ) was attempted, using a hydroxide flux technique, and a solid state reaction technique. After the synthesis of each pure sample, optical measurements were performed to determine the optical properties of the compounds.  $\text{NaLnGeO}_4$  for  $\text{Ln} = \text{Sm}, \text{Eu},$  and  $\text{Gd}$  was successfully synthesized.  $\text{Na}_5\text{Ln}_4\text{Ge}_4\text{O}_{16}(\text{OH})$  for  $\text{Ln} = \text{Sm}$  and  $\text{Eu}$  was successfully synthesized.  $\text{LnO}(\text{OH})$  for  $\text{Ln} = \text{Sm}$  was successfully synthesized. Of the compounds successfully synthesized crystallographic data was gathered using single crystal x-ray diffraction. Due to time constraints optical measurements were only performed for  $\text{NaEuGeO}_4$ .

## THE COMPARISON BETWEEN THE TEAR-STRENGTH OF RECYCLED AND NEW FABRICS

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The purpose of this experiment was to determine the tear-strength of synthetic fabric and compare it to the tear-strength of cotton and wool fabrics. The hypothesis states that the tear strength of cotton will be greater than the tear-strength of synthetic and wool fabrics. The independent variables are the types of fabric: cotton, synthetic, and wool and the dependant variable was the tear-strength. The fabrics were cut at 9in. x 3in and they were not cut on the bias. The fabrics were attached to a static beam at the top then attached to a dynamic beam with a carrier for weights. The amount of weight in pounds increased by 2 pounds until the fabric failed. A total of 8 tests were run. The amount that the fabric stretched after each weight increase was measured. These tests results suggest that synthetic fabrics had the greatest tear-strength and cotton fabrics stretched the longest. The ANOVA had a F of 333.7 and an F-Critical of 3.1. The results from the F and the F-Critical showed that most of the collected data were statistically different. This rejected the null hypothesis of the fabrics' stretch lengths being equal and failed to reject the hypothesis of cotton and polyesters' stretch lengths being higher than synthetic.

## KRUPPEL-LIKE FACTOR 4 ALPHA (KLF4A) SUPPRESSES BREAST CANCER DEVELOPMENT

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Kruppel-like factor 4 (KLF4) is a transcription factor involved in cellular differentiation and proliferation. However, the role of KLF4 in breast cancer development is controversial. Some reports suggest that KLF4 acts as an oncoprotein in breast cancer while others show it functioning as a tumor suppressor. In a separate study, it was reported that KLF4 acts as a tumor suppressor in pancreatic cancer development. In contrast, it has recently been reported that KLF4 $\alpha$ , an isoform of KLF4, behaves as an oncoprotein in pancreatic cancer. We examined whether KLF4 functions as a tumor suppressor and KLF4 $\alpha$  as an oncogene in breast cancer development. To test this hypothesis, we transfected either KLF4 or KLF4 $\alpha$  into 4T1 breast cancer cells, injected these cells into Balb/c strain mice, and observed tumor development. Our results showed that KLF4 $\alpha$  inhibited tumor growth. The KLF4-injected mice developed tumors to a similar extent as vector-injected mice. Taken together, these results support the idea that KLF4 $\alpha$  acts as a tumor suppressor in breast cancer cells. From these results, better



chemotherapeutic techniques could be developed to activate certain KLF4 $\alpha$  genes and prevent cancerous cells from arising and metastasizing.

#### WHAT ARE THE EFFECTS OF BACKGROUND COLOR AND FACIAL SYMMETRY ON ATTRACTIVENESS?

Larissa Heslop  
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This experiment was conducted to test if symmetrical faces are more attractive than asymmetrical faces, and if the color background of a picture affects the perceived attractiveness. The original asymmetrical faces were altered by a website that altered the faces to be symmetrical. The website was <http://www.symmeter.com/symfacer.htm>. Volunteers were asked to rate the attractiveness of facial images. Averages of the ratings of symmetrical faces were compared to the averages of original faces. The average ratings of pictures placed on a warm colored background were compared to pictures on a cool color background. Warm colors include red, orange, yellow, and pink. Cool colors include green, grey, blue, and purple. The hypothesis for the symmetry of the faces stated that the symmetrical faces were going to be rated higher than the original faces. The second hypothesis was that the cool colors would make a picture rated higher on a scale of zero to twenty. Due to the process of altering the images, the result of the experiment suggested that an original face was more attractive than a symmetrical face. Also, pictures with cool color backgrounds were rated higher compared to warm color backgrounds.

#### THE EFFECTS OF COMETICS ON SUS SCROFA DOMESTICUS' SKIN

Natalie G. Hicks  
Greenville Technical Charter High School

Humans share 98% of the same DNA as pigs. Due to the similar genetic make-up, pig skin is often used to test affects certain chemicals would have on human skin. It is hypothesized that the cosmetics will have a negative effect on the pig skin and that liquid products would have a greater effect than powder or stick products. For the experiment, samples were taken of fresh pig skin and equal amounts of foundation (liquid and powder), concealer (liquid and formula), eyeliner (liquid and pencil), blush (powder and crème), and eye shadow (stick and powder) were applied daily. Each type of cosmetic remained on the samples for thirteen hours before being removed using a makeup remover wipe. This process was repeated for four days. Each day after the cosmetics were removed the samples were examined under a microscope to determine any physical changes.

#### THE EFFECTS OF SLEEP DEPRIVATION ON REACTION TIME

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The purpose of this experiment is to examine the effects of sleep deprivation on reaction time. This study is being conducted to find out whether a person's reaction time is affected by getting either more sleep or less sleep. It is hypothesized that if a person receives a larger amount of sleep, up to 10 hours, then their reaction time will decrease in a direct proportion to the amount of sleep they received. If a person receives a lower amount of sleep, down to 4 hours, then their reaction time will increase in a direct proportion. The null hypothesis states that a person that receives a larger amount of sleep up to 10 hours and a person receives a lower amount of sleep down to 4 hours will have no change in their reaction times. We gathered a group of 20 subjects ranging from 7th grade through ninth. We asked them to receive a certain amount of sleep at night and then had them take a reaction speed test the next morning. We repeated this process for 4 hours, 6 hours, 8 hours, and 10 hours. The results of the reaction speed tests were recorded and compared. In our conclusion we discovered that our hypothesis was correct. On average, when subject *a* received lesser amounts of sleep they did have a slower reaction time. When subject *a* received a higher amount of sleep they did in fact end up having a faster reaction time.

#### AN ANALYSIS OF BEHAVIOR IN SIMULATED SLOT MACHINE GAMBLING

David J. Hodge  
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From the 1970s to the present, gambling has become an increasing problem in the United States. Though little research has been concluded on gambling, it is now more available and more predatory than ever, as pathological gambling rates have risen from 0.77% to 5% in the past four decades (Ashley &Bochlike 2012). The purpose of this experiment was to supplement the small amount of research that has been done on the growing problem of gambling in the United States by analyzing slot machine exposure over time and variation of base betting amounts in simulated slot machine gambling. The slot machine simulation used in this research was generated by Casino.com. Two experiments were conducted; the first tested the effect of exposure to simulated slot machine gambling on the number of spins and the amount bet by human subjects. In this

experiment, it was hypothesized that participants show less gambling activity, choose to gamble for a lesser amount of time, and choose to play the slot machine fewer times as they were exposed to the slot machine simulation more after the initial session. The results, that subjects gambled fewer times and for a shorter time period in the final session than in the initial session, supported the hypothesis, where  $p < 0.001$  for time played and  $p = 0.023$  for number of spins at  $\alpha = 0.05$ . Therefore, Experiment 1 indicates that slot machine exposure had a statistically significant effect on how long and how many spins the participant plays. The second experiment analyzed the effect of the size of the wager per spin on the total outcome of slot machine gambling. The results rejected the hypothesis, that the size of the wager had an inverse relationship with the amount of credits earned. Experiment 2 shows that the \$4 wager per spin yields the greatest net profit, \$10 yields the second greatest but only with a large jackpot, and \$1 and \$2 yield slight net losses. This analysis of gambling behavior should raise the public awareness and knowledge about the predatory practices involved with slot machine gambling.

#### THE EFFICACY OF COPPER VERSUS STAINLESS STEEL IN REDUCING VIABLE BACTERIA ON SURFACES IN PUBLIC AREAS

Katharine T. Hoffman  
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There is increasing concern over the growing number of antibiotic resistant bacteria in our everyday environments. It has been suggested that antimicrobial copper could be used as an alternative for stainless steel in public facilities to reduce the occurrence of bacterial infections in humans. The aim of this study was to compare the biocidal potential of 100% copper versus stainless steel against bacteria collected from human hands. 10 human participants placed their right hand onto a stainless steel plate and a copper plate on two separate days. At 0, 15, and 30 minutes after contact, bacterial samples were collected from the plates with cotton swabs and rinsed with Luria Broth into test tubes. Serial dilutions of the bacterial suspensions were plated in quadruplicate, and the number of bacterial colonies on each plate were counted three days after plating. Copper was found to have the highest biocidal efficacy with few viable cells being detected following exposure to the metal for 30 minutes. Statistical analysis for the results on the efficacy of copper showed statistically significant data when compared to stainless steel. There was a statistically significant difference between the number of colonies grown from copper and stainless steel on day 3 of testing at 15 minutes after contact ( $p=0$ ), and at 30 minutes after contact ( $p=0$ ). Future research could study the mechanisms of copper induced bacteria death. Analyzing different bacterial strains and their resistance to copper could also be studied.

#### THE EFFECTS OF ANG-2 STIMULATION ON HUMAN BRAIN PERICYTE EXPRESSION OF PLATELET-DERIVED GROWTH FACTOR RECEPTOR-BETA

Tobias Holden  
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Angiogenesis is the branching of existing blood vessels within the human body, to supply oxygen and nutrients to an area of hypoxia or pathological distress. In cancer, tumor cells have an acquired capability of sustained angiogenesis, which allows the rapidly proliferating cells of the primary tumor to thrive. Previous research has shown that the activation of the Angiopoietin-2 / Tie-2 signaling pathway causes a down-regulation of the recruitment and motility protein, platelet-derived growth factor receptor beta (PDGFR- $\beta$ ) on pericytes during tumor angiogenesis, resulting in pericyte detachment and vascular destabilization. Contrarily, recent observations show that in intermediate Ang-2 concentrations, pericytes are tightly bound to endothelial cells releasing Ang-2. To confirm this observation, human brain pericytes were cultured in 8-well micro-slides and stimulated for 20 minutes with Ang-2 ranging in concentration from 25ng/ml to 400ng/ml, including unstimulated controls. The cells were fixed in ice-cold methanol for ten minutes and either stained for PDGFR- $\beta$  expression, or lysed and prepared for Western Blot Protein Analysis. The immunofluorescence stainings and Western Blot analysis of cell lysates showed significantly higher intensity ( $p < 0.0001$ ) in the 25ng/ml stimulated cells when compared to unstimulated and 400ng/ml Ang-2 stimulations. Future research will narrow down Ang-2 concentration ranges to pinpoint the threshold for angiogenic activity, with potential uses in cancer treatment and therapy.

#### HOW DO DIFFERENT FOODS AFFECT THE GROWTH OF MICE (RATTUS NORVEGICUS)?

Sophia Holt  
Heathwood Hall

How do different foods effect the growth of mice (*Rattus norvegicus*)? This project was to find out what foods caused mice to gain weight. This could possibly relate to humans as well. The foods used were bologna, carrots, celery, bread, and mice food. Once everything was purchased, the mice were weighed on the first day. They were weighed on Mondays and Thursdays. The

food bowls were refilled once a day. The cages were cleaned on Mondays. The independent variable is the foods. The dependant variable is the weight gain. The results stated the control group had the most weight gain with an average of 13.92 g. The vegetable group had the least growth with an average of 1.16 g. The carbs group was 2<sup>nd</sup> lowest with 4.32 g as the average. Protein had an average weight gain of 8.06 g. The Anova test showed that the f value is higher than the f-critical by 1.52. This shows there was a significant difference in the different food types. The conclusion is that if a person wants to fatten up their mice for a snake or other pet, feed the mice the normal mice food.

THE DEVELOPMENT OF 3D MODELING IN *LOST IN THE MIDDLE KINGDOM*, A SECOND LANGUAGE ACQUISITION VIDEO GAME

Morgan Honaker  
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This research project furthered the development of *Lost in the Middle Kingdom*, an educational video game designed to teach Chinese as a second language. The game utilizes a principle called the second language acquisition (SLA) theory which is based upon the idea that subconsciously learning a language is more effective than conventional memorization methods of language education. *Lost in the Middle Kingdom* fulfills SLA theory by plunging its user into an almost entirely Chinese-speaking universe with interactive game-play and sophisticated graphics. The Unity Game Engine served as the integral development platform for the game because of its implementation of the C# programming language and its compatibility with the modeling software Blender. Although still in development, *Lost in the Middle Kingdom* will eventually consist of twenty different levels categorized by a particular aspect of daily life such as time or family. Blender was used to construct the different buildings, furnishings, and landscapes that composed the environment of each level. The modeling software had a plethora of effects as well as an inventory of basic geometric objects such as spheres, cubes, and cylinders that were necessary to build realistic, refined game objects. However, despite Blender's multiple features, it relied on an aptitude for manipulating vertices into the desired shape. Also, using Blender to apply images to objects with image and procedural texturing was a critical step in developing realistic environments for *Lost in the Middle Kingdom*. Over the course of this project many visual aspects of the game were completed, including the entirety of the dates and times level, a barber shop, and several miscellaneous furnishings such as televisions, soccer goals, and fountains. However, *Lost in the Middle Kingdom* still requires significant development in the areas of programming and 3D modeling.

THE EFFECT OF PAPER COLOR ON THE ABILITY TO MEMORIZE AND RECALL WORDS

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In this experiment the effect of paper color on the ability to memorize and recall words was examined. The purpose of this experiment was to determine if warm colored paper have an effect on the average of words recalled, words spelled correctly, and the time it took to complete the test by high school students. The hypothesis stated that if the words to be memorized were presented on warm colored paper, then students would have a greater percentage of words recalled than if the words were presented on cool colored paper or white paper. Ten participants were asked to take a test on white and colored paper, forty participants in total, to memorize and then recall words on white paper, as well as on one of the following colors: blue, orange, violet, or red. They were asked to do this twice, and had two minutes to memorize the words, one minute to talk, then two minutes to recall the words. It was found, the average number of words recalled on blue paper was highest; students who took the test on blue paper also had the highest average of words recalled and took the longest time to complete the test, this was most likely because they took the time to recall and write the words down. The null hypothesis was rejected, and the hypothesis could not be fully accepted. An alternative hypothesis that blue paper helps high school students recall words better than white, orange, red, and violet paper was accepted.

THE EFFECT OF THRUSH OFF™, THRUSH XX™ AND CLOROX® AS MEASURED BY THE ZONE OF INHIBITION OF *FUSOBACTERIUM NECROPHORUM*

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The Equine industry has proven itself to be a substantial field of business; however, in order to perform, compete and train at the highest level, owners need to have a healthy horse, starting with a sound hoof. The presence of *Fusobacterium necrophorum* in conjunction with other bacterium in the hoof is also known as thrush or hoof rot. When not treated properly, *F. necrophorum* can become imbedded in the sulci, white line and sole of the hoof, causing pain and destruction of the sensitive hoof tissues. It is evident that the treatment of *F. necrophorum* is necessary to ensure a sound hoof and a sound horse. This study was conducted to determine the efficiency of commercial products such as Thrush Off™, Clorox® bleach and Thrush XX™ on the treatment of *Fusobacterium necrophorum* as measured by the zone of inhibition. In this study, Petri

plates with Brucella Blood Agar were spread with a liquid culture of *F. necrophorum*. Six millimeter cellulose disks were submerged in each treatment and placed on the Petri plates, one for each treatment on each plate. Data was collected after twenty four hours and seventy two hours, and statistical analysis was run on the data using a single factor ANOVA test ( $\alpha < 0.05$ ) and descriptive statistics test, resulting in a statistical difference between the treatments. Tests showed that Thrush XX™ had a significantly greater zone of inhibition ( $p > 0.05$ ) when compared to the control (water), followed by Clorox, water, and Thrush Off™ respectively. The null hypothesis stating if *Fusobacterium necrophorum* was treated with Thrush Off™, Clorox® bleach and Thrush XX™ then there will be no difference in the effectiveness of the products on the growth of *Fusobacterium necrophorum* as measured by the zone of inhibition was rejected. The hypothesis stating if *Fusobacterium necrophorum* was treated with Thrush Off™, Thrush XX™, Clorox® bleach, and water then there will be a difference in the zone of inhibition of *Fusobacterium necrophorum* as measured by the zone of inhibition failed to be rejected.

#### THE CONSTRUCTION AND VALIDATION OF AN ELLIPSOMETER THROUGH THE MEASUREMENT OF AL<sub>2</sub>O<sub>3</sub> FILM ON SILICON

Brian Hurst **Error! Bookmark not defined.**  
Governor's School for Science and Mathematics

The study completed here entailed the construction and validation of an ellipsometer on an optical table. An ellipsometer was constructed because of the unique capabilities and properties, such as the wide variety of conditions it is operable under and the quick data collection time. The lab at the USC wanted an ellipsometer so that thin film deposits on turbine blades could be measured quickly and accurately. The study began with an inventory of the available parts, and after ordering the missing pieces, construction began. After the ellipsometer was constructed, it was validated using a piece of aluminum oxide film on a silicon substrate. Because the film was made by atomic layer deposition, the sample provided a precise thickness for comparison of the ellipsometric results. It was concluded that it would be advantageous to purchase a commercially manufactured ellipsometer as a table ellipsometer did not provide the accuracy or precision the study hoped to achieved.

#### THE INFLUENCE OF SOCIAL NETWORKING ON TEENAGE DECISION-MAKING

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As the usage of social networking websites among teenagers increases dramatically, it is important to analyze the effects of social media on daily activities. The purpose of this experiment was to determine the influence of social networking websites, namely, Facebook and Twitter, on teenage decision-making on whether to participate in an annual blood drive. It was hypothesized that teenagers exposed to encouraging Facebook and Twitter posts/tweets supporting the blood drive would be more likely to participate in the blood drive, when compared to students who were not exposed to these types of posts/tweets. Participants were requested to complete a survey with questions about their internet usage, social networking usage, and their opinions on the internet's influence on their decisions. Students were requested to provide their Twitter username and Facebook username information to the researcher, although they were not informed about how this information would be utilized; instead, the researcher informed participants that their usernames were being requested so that the participants could be contacted if questions arose about their answers on the survey. Students were then randomly placed into either the experimental group, whose participants were exposed to posts/tweets supporting the blood drive, or the control group, whose participants were blocked from seeing such posts/tweets. For the following month, participants in the experimental group were exposed to posts on Facebook/ tweets supporting the blood drive, while participants in the control group were not exposed to these posts/tweets. When the day of the blood drive arrived, the number of students volunteering to donate blood from both groups, experimental and control, was compared and results analyzed. Additionally, data on the number of students signing up for the blood drive just one week prior to its arrival were recorded. Following the study, students were debriefed and told that their Twitter/Facebook usernames were really being used to monitor the influence of social networking on teenage decision-making. A Chi-squared test for independence was run at the confidence level of  $\alpha = 0.05$ ,  $\chi^2(2, N = 50) = 9.93$ . It was discovered that  $p < 0.001$ ; thus it was found that the participant's decision to donate blood was dependent upon his or her group placement, as hypothesized. Participants who had been exposed to encouraging posts about the blood drive were more likely to succumb to the influence of the social networking websites and choose to donate blood when compared to participants in the control group.

## EFFECT OF DIFFERENT LIQUIDS ON MAGNETIC FIELD

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Hammond School

This experiment was conducted to find the influence of different liquids on the strength of a magnetic field. The question of the experiment was "what is the effect of different liquids on a magnetic field?" A magnet was placed in six different liquids relative to an identical magnet which was placed outside the liquid. The force of the magnetic field was determined by measuring the distance between the two magnets as the magnets attracted each other. The interesting result of the experiment proved the hypothesis "a liquid can strengthen or weaken a magnetic field". The result showed that liquids such as orange juice, Gatorade, and coke created a stronger magnetic force. Milk actually weakened the force. Water and vinegar did not affect the magnetic field. It is discussed that the effect of liquid could be related to the concentration of iron ion in the liquids. Orange juice with higher concentration of iron created the strongest magnetic force, while water with no iron had no effect. Milk had negative effect even though it has low amount of iron. Indeed, the denser milk created a thick wall around the magnet, which weakened the magnetic force. This result can be useful in medical field, when magnetic field is used for human body to take MRI images.

## THE EFFECT OF NATURAL LIGHT VERSUS ARTIFICIAL LIGHT ON TASK COMPLETION ACCURACY AND SPEED OF COMPLETION IN STUDENTS.

Michaela D Jenkins  
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One would think that the light technology would only be positive effects on humans. However, there are many biological advantages to natural light that cannot be found in artificial light. The purpose of this experiment is to determine the effect that natural light has on the task completion accuracy and speed of completion versus the effect that artificial light has in students. It was hypothesized that if participants were exposed to natural light or artificial light are given computational, logic, and speed based tasks to complete, then participants exposed to natural light will have a faster speed of completion and accuracy in their tasks than participants exposed to artificial light. Participants were tested under daylight, 3500K, 4100K, and 6000K wavelengths of light. In the data collected, it was found that for the most part, daylight wavelengths did not show a statistical significantly different importance when it came to the speed of completion and accuracy under most wavelengths. The only statistical significance that rejected the null hypothesis was accuracy in the third test trial between the daylight wavelengths and the 4100K wavelengths. From this information it can be concluded that the data failed to reject the null hypothesis and rejected the hypothesis.

## AN ANALYSIS ON THE CREATION, COMPOSITION, AND STRUCTURE OF BIO-PLASTICS

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During the research portion of this project, we discovered that many plastics were composed of inorganic materials, aside from a select group labeled "bio-plastics". These bio-plastics were heralded as being able to decompose a thousand times faster than the commercial plastics. In this experiment, three different bio-plastics were created, two with glycerin (propane-1,2,3-triol) serving as a plasticizer, and another with vinegar as a plasticizer. Some manufactured bio-plastics utilize biodegradable materials as their polymers and plasticizer, however, most of them also find needs for an additive, which enhances the appearance and strength of the bio-plastic. The process of creating these bio-plastics is composed of several simple steps. First, the ingredients were mixed in their respective containers, until they were mostly clear. Next, the mixed ingredients were placed on a stovetop, and heated to a temperature around 95 C°, which is the boiling point of agar. Finally, they were spread out on cooling sheets to harden and form the desired bio-plastic. The first bio-plastic that was created was a mixture of agar, the polymer, a 1% glycerol solution, which served as the plasticizer, and water. The second bio-plastic was a simple mixture of household ingredients, corn starch, served as the polymer, pure glycerin, the plasticizer, and vinegar, and additive. The final "bio-plastic" was a glorified cheese, as there was no true polymer or plasticizer, with the only two ingredients being vinegar and half-half. We found that the hybrid "cheese-plastic" was the least effective at holding any type of weight, and therefore proving ineffective as a bio-plastic. Upon research, we concluded that the most effective replacement for an actual plastic would be the bio-plastic composed of corn starch and glycerin, as it held the most weight when tested.

## THE TENSILE STRENGTH, THERMAL CONDUCTIVITY, AND ELECTRICAL CONDUCTIVITY OF SPIDER SILK FROM ORB WEAVERS (*NEPHILA CLAVIPES*) AND GARDEN SPIDERS (*ARANEUS DIADEMATUS*)

Alexis Jones  
Spring Valley High School

According to many different sources, spider silk has incredible physical and chemical properties. The purpose of this project was to test the properties of spider silk, including strength, thermal conductivity, and electrical conductivity. It was hypothesized that spider silk would conduct electricity and heat, and that one 4.5 mm strand would be able to maintain at least 2N of force before it broke. There were several methods for conducting the experiment. For calculating strength, a force probe was attached to a ring stand. The spider silk was connected to the probe and pulled on slowly until it reached its breaking point. The highest amount of force that the spider silk maintained before it broke was recorded. The test for determining electrical conductivity involved the use of an ohms meter. One alligator clip was connected to one side of the ohms meter. The other side of the alligator clip was connected to one end of the spider silk. The other alligator clip was connected to the other side of the ohms meter and the other side of the spider silk. The number of ohms of resistance was recorded. Thermal conductivity was tested using the Vernier Temperature Probe. The results showed that on average, spider silk had strength of 2.349N per every strand of silk, 4.5mm in diameter. For the same width, the ratio for thermal conductivity was, on average, 6.37. The spider silk was not a good conductor of electricity; it actually resisted electricity at more than 2 million ohms. Spider silk showed to be able to maintain a great amount of force. It was a conductor of heat, but an insulator of electricity.

## THE PERCENT PRESENCE OF GMO- ASSOCIATED DNA SEQUENCES IN 3 DIFFERENT BRANDS OF BACON

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The purpose of this experiment was to investigate the percent presence of GMO-associated DNA sequences in 3 different brands of bacon, Carolina Pride, Oscar Mayer, and Hormel Natural. The bacon products were liquefied and placed into three separate beakers. Additionally the GMO Investigator Kit provided a Bio-Rad Certified Non-GMO food control as well as a GMO-positive control DNA. Each bacon sample was mixed with 500  $\mu$ l of InstaGene matrix, the non-GMO food control was also mixed with 500  $\mu$ l of Instagene Matrix. Two master mixes were then formed, one using GMO primers and one using Plant primers. The third master mix served as the GMO-positive DNA template. Two PCR's were performed on these bacon samples, one using GMO primers and one using Plant primers to amplify the possible GMO- associated DNA sequences. The samples were then run through on a 3% agarose gel in TAE Buffer, using gel electrophoresis. The gel was run at 200V for 20 minutes. It was stained with 100x Fast Blast DNA stain and examined to determine the presence or absence of the GMO-associated DNA sequences. After the gels were stained they were copied into lab books and analyzed. The results indicated that Carolina Pride was GMO-positive and Hormel Natural was a non-GMO food. The Oscar Mayer gel electrophoresis also indicated a GMO- positive result; however, the protocol did not work since the Plant primers with the test food did not generate the required 455bp band on the gel. Therefore, only two conclusions can be made about the presence of GMO-associated DNA sequences.

## THE EFFECT OF FEEDING FORMULATED SUSTAINABLE MEALS ON THE GROWTH OF LITOPENAEUS VANNAMEI

Olivia Joslin  
Hilton Head Island High School

The purpose of this experiment is to develop a sustainable, inexpensive, and original food source for farm raised shrimp that results in weight gains similar/greater than the weight gain of shrimp fed fishmeal. Meal 1 was made up of vegetable protein powder, peanut flour, and Porcini mushroom powder. Meal 2 consisted of wheat isolate 8000, peanut flour, and Porcini mushroom powder. Both meals contained a little fish oil (attractant) and both were formulated to have optimum levels of fats, carbohydrates, and proteins.

168 shrimp were weighed and divided equally among 6 aquaria/tanks. Shrimp in tanks 1-2 were fed Meal 1. Shrimp in tanks 3-4 were fed Meal 2. Shrimp in tanks 5-6 (control) were fed their regular, environmentally harmful and increasingly expensive, diet of fishmeal. After ten days the shrimp were re-weighed. It was predicted that the shrimp fed Meal 1 would gain the most weight followed by shrimp fed Meal 2 and fishmeal. This was predicted because both meals were designed to be competitive with fishmeal, but Meal 1 contained vegetable protein, which, according to research, results in weight gain in shrimp.

Results were analyzed by conducting 2 sample Z Tests for means. According to the 2 sample Z Tests for means, it can be concluded that the shrimp fed Meal 1 or Meal 2 had essentially equal weight gains when compared with the weight gains of the shrimp fed Meal 3. This experiment showed that Meal 1 and Meal 2 could be used as alternative, sustainable meals for farm raised shrimp and would result in weight gains that are statistically equivalent to that of shrimp fed fishmeal.

## STUDY OF VARIOUS LEVELS OF PROTEIN EXPRESSION IN THE INACTIVE STATE OF DIFFERENT CONCENTRATIONS OF HUMAN THYMIDYLATE

Hannah Kahng

Governor's School for Science and Mathematics

The enzyme, thymidylate synthase (TS), has been the target for drugs in colon cancer therapeutic treatments. However, the effectiveness of these treatments has been hindered by drug resistance in cancer cells, commonly associated with increased levels of TS that occur as drugs bind to the active state. Human TS (hTS) is distinctive among thymidylate synthases from all species, differing in that the protein can undergo conformational switching between the active state and a novel state, termed the inactive state. The hypotheses that we examined are that the inactive state of hTS is a target for cancer drug discovery and that such drugs will not elevate the levels of TS, reducing the potential for resistance. The goal of the project was to analyze the levels of hTS in cell lines as an initial step in analyzing the function of the inactive state. The levels of expression of the inactive hTS protein was studied through SDS polyacrylamide gel electrophoresis and western blotting. This study allowed us to determine the levels of hTS in a cell line that was engineered to express hTS stabilized in an inactive state. This cell line was an important resource for determining whether targeting the inactive state of hTS is an approach to reducing drug resistance in cancer cells. With the addition to western analysis, protein analysis was conducted. Our hypothesis that the inactive state of hTS is protective against oxidative stress was supported by analysis.

## THE EFFECT OF CONGAREE RIVER WATER SAMPLE PROXIMITY TO THE COLUMBIA METRO WASTE WATER TREATMENT PLANT ON THE PRESENCE OF ANTIBIOTIC RESISTANT BACTERIA

Sunaina Kapur

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The purpose of this experiment was to determine the effect of the Congaree River water sample proximity to the Columbia Metro Waste Water Treatment Plant (WWTP) on the presence of antibiotic resistant bacteria. It was hypothesized that if the proximity of Congaree River water samples to the WWTP on the presence of antibiotic resistant bacteria was measured, then the bacteria would be more antibiotic resistant the closer the water was to the WWTP. Water samples were collected from the source upstream, the source effluent, and the source downstream from the WWTP of the Congaree River. The sample collected from the effluent of the WWTP was the closest to the WWTP. Different doses of Ampicillin were placed in the water samples; no Ampicillin, a low dose of Ampicillin (15  $\mu\text{g/ml}$ ), a high dose of Ampicillin (30  $\mu\text{g/ml}$ ), and sterile water were added to 3 plates from each sample. Statistical analysis showed statistically significant difference between the mean of bacteria between upstream and downstream, between effluent and downstream, and between upstream and effluent. The samples from downstream contained the largest number of antibiotic resistant bacteria with no Ampicillin in it and for the high dose of Ampicillin (30  $\mu\text{g/ml}$ ) in it. Both of these rejected the hypothesis. The samples from the effluent contained the largest number of antibiotic resistant bacteria with a low dose of Ampicillin (15  $\mu\text{g/ml}$ ) in it. This accepted the hypothesis. Ampicillin failed to kill the majority of the bacteria, which confirmed other researchers' findings.

## SYNTHESIS AND SINTERING OF YTTRIUM ALUMINUM GARNET (YAG)

Michael Keating

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Yttrium aluminum garnet ( $\text{Y}_3\text{Al}_5\text{O}_{12}$ , YAG) has become regarded as one of the most popular and useful transparent ceramics. This is due to its high thermal stability and desirable optical properties. YAG is used in many laser and lighting applications, often doped with rare earth metals. It has been proposed as a scintillator as well. In this work, we aim at investigating the effects of the sintering temperature on the pore content, since pores induce light scattering and reduce the optical transparency of YAG ceramics. The pore content of undoped polycrystalline YAG will be evaluated by means of density and positron annihilation spectroscopy (PAS) measurements, the latter to be performed at Christian Texas University. YAG powders were synthesized from yttrium nitrate and aluminum nitrate using ammonium hydroxide as the precipitant, followed by calcinations under  $\text{O}_2$  flux. These calcinations were carried out at 450°C for 30 minutes, 1100°C for 2 hours, and again 450°C for another 30 minutes. X-ray diffraction measurements determined the structure of the calcined powder to be cubic. Vacuum sintering was carried out for a time period of 20 hours at varying temperatures within the range 1400 to 1700 °C.

## THE DESIGN AND IMPLEMENTATION OF MINI-GAMES IN *LOST IN THE MIDDLE KINGDOM*: AN INTERACTIVE CHINESE-INSTRUCTIVE GAME

Edward Kim

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The Chinese language is considered by many English speakers as one of the hardest languages to master. Therefore, many language software companies such as Rosetta Stone® attempt to develop quality software that effectively teaches Chinese. Using the "Immersion" technique, language learning computer programs have in general received positive reviews. However, these methods may not engage the user to the fullest extent and the software may run into problems similar to those coming from a classroom environment. The goal of this research stems from the attempts to engage the user by placing him or her in a game-simulation environment, *Lost in the Middle Kingdom*. In the mini-games created in this project, each level consists of a story which the user must pay attention to in order to learn characters. Many interacting objects in the game can be clicked to reveal a unique graphical user interface which consists of the Chinese character representing the object, the Pinyin representation of the object, and a sound file which pronounces the Chinese word. The user then interacts with the non-player characters (NPCs), to complete tasks. The mini-games are integral to immersion learning process for each player. As a result, a level was developed using the implementation of several mini-games as well as a "level manager". A random question generator was also developed to pose a question from a question bank. With the benefits of the immersive learning process and GUI based game engine, this program is a promising instrument in learning Chinese for English speaking students.

## INHIBITORY EFFECTS OF TURMERIC, THYME, CINNAMON, AND ACNE FACE TONER ON *STAPHYLOCOCCUS EPIDERMIDIS*

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The purpose of this study was to determine the effects of turmeric, thyme, cinnamon, and acne toner on inhibiting the growth of *Staphylococcus epidermidis*. This study explored the use of natural cooking spices such as turmeric, thyme, and cinnamon as possible antibacterial skin agents.

The approach used was to inoculate the pre-poured petri dishes with *Staphylococcus epidermidis*. Every petri dish was streaked with bacteria from the *Staphylococcus epidermidis* culture with sterile cotton swabs. Each spice was then mixed with equal amounts of olive oil to achieve a liquid solution with an even distribution. Then, blank sterile paper discs were soaked in each of the liquid spice solutions. Discs were also soaked in the acne toner and olive oil (control). All of the soaked discs were then placed on the inoculated petri dishes and incubated at 37 degrees Celsius for 48 hours. Then, a vernier caliper was used to measure the diameters of the inhibition zones around each disc.

Only the thyme and toner had inhibition zones, while the turmeric, cinnamon, and olive oil had no inhibition zones on any of the petri dishes. An ANOVA single factor test with the level of significance set at 0.05 partially supported the hypothesis of toner having greater inhibition zones than the cinnamon and turmeric. A t-Test with the alpha level set at 0.05 partially supported the null hypothesis because there was no difference between the means of thyme and toner.

## QUANTITATIVE ANALYSIS OF *IN VIVO* FLUORESCENCE MICROSCOPY FOR DRUG DELIVERY STUDIES

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Mild hyperthermia can trigger the rapid release of chemotherapeutic drugs in solid tumors. This study deals with the release of the drug doxorubicin from liposomes injected into mice with dorsal skin-fold window chambers. The mild hyperthermia was triggered by a heating coil attached to the back of the glass of the window chamber. The concentration of the doxorubicin in the tumor's blood vessels and in tissue can be imaged using intravital laser scanning confocal fluorescence microscopy. These images were then processed using MeVis lab software, a program for analyzing medical image stacks. To correct for tissue motion, each image of the stacks were registered to the first image of each stack. With the two new stacks, vascular and extravascular regions were identified by overlaying both channels from the original microscopy film, one channel showing the fluorescent green marked endothelial cells and the other showing the release of the fluorescent red doxorubicin from the liposomes. The vasculature from the green channel that was not pertinent to the release of the drug was erased from the vascular mask, and an extravascular mask was also made to mark the tumor's tissue. Average fluorescence intensity (representing drug concentration) was calculated for each of four data sets, obtained simultaneously from four different points in the same tumor. The results demonstrate that quantitative analysis of fluorescence microscopy images allows measurement of drug concentrations and therefore could be used to evaluate drug delivery systems such as liposomes.



ANALYZING THE DECAY OF THE HIGGS BOSON TO C-CBAR AND B-BBAR VIA JET RECONSTRUCTION ON A MONTE CARLO PARTICLE PHYSICS SIMULATOR

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The Higgs Particle (recently discovered) is a boson that is essentially responsible for the differentiation of mass between different particles. The existence of this boson explains why particles have mass; it is also a major key in a unified theory of the fundamental forces. However, there is still some mystery surrounding the particle. In this research, a Monte Carlo particle physics simulator (named PYTHIA8) was used to closely analyze the decay of the Higgs boson into the quarks *b* and *bbar*, as well as the quarks *c* and *cbar*. A separate program was made for each of the two decay channels. In each program, a Higgs boson of mass 126GeV/c (around  $2.2428 \times 10^{-25}$ kg) was produced from the collision of two protons moving with CM energy of 8000GeV. The quarks that formed from the decay of the resulting Higgs were 'shot out' in opposite directions, undergoing hadronization and creating large jets (streams of hadrons and various particles). These jets were then tagged using a jet reconstruction algorithm. The tagged jets were analyzed and differentiated according to quark decay. The result of this research was that *b-bbar* quark decay can be well distinguished from *c-cbar* quark decay, as well as other forms of heavy quark decay.

THE EFFECT OF SOIL SALINITY ON THE OXYGEN PRODUCTION OF *PISUM SATIVUM VAR SATIVUM*

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Plants in areas of great salt concentrations require special methods to be able to grow and survive. The purpose of this experiment was to determine which levels of salinity would be best for growth and oxygen production of *Pisum sativum var sativum* (Alaskan Peas). It was hypothesized that as the salinity levels increase, the oxygen production of *Pisum sativum var sativum* would decrease. Plants were exposed to salt levels of 2.5 grams, 1.75 grams, 1 gram, and 0 grams (control). Plants grew for about one month before treatments. The seeds were all planted in a uniform measure of 1 cup of soil in a large styrofoam cup and watered daily. After 30 days, pre-measured amounts of salt were poured into the cups and then mixed into the soil. By using a Vernier O<sub>2</sub> Gas Sensor and Vernier Labquest, data were taken when each plant was placed in an airtight container with the sensor, which recorded and delivered the oxygen production in percentages. The mean oxygen production for the plants in the higher soil salinity treatments significantly decreased over time as seen in  $F(6, 747) = 9.17, p < 0.001$ . However, the mean production of the control did not vary. The study supports the hypothesis and indicates that the mean oxygen production of plants in lower soil salinity concentrations tends to be greater than plants in high soil salinity concentrations.

THE EFFECT OF FCCP ON CALCIUM CHANNELS IN THE HEART

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Carbonylcyanide-4-(trifluoromethoxy)-phenylhydrazone (FCCP) is a protonophore commonly used in pharmacological experiments. As a known mitochondrial uncoupler, FCCP produces reactive oxygen species (ROS) and decreases calcium currents. While in small doses ROS are healthy contributors to signaling in the cell, in large amounts they can cause damage to the cell by eliminating the membrane potential. This study was done to determine whether or not the ROS produced by FCCP were the cause of the decrease in calcium current. DTT, tempol, and glutathione, all ROS scavengers, were applied along with FCCP to see whether the suppression of the calcium current caused by FCCP would be stopped. Results showed that the effects of FCCP were partially reduced by the ROS scavengers. This suggests that there is another factor produced by FCCP that is causing the decrease in calcium current.

A COMPARISON OF CaCl<sub>2</sub> AND KCl MODIFIED ORANGE PEEL BIOSORBENTS ON THE ADSORPTION OF Cu<sup>2+</sup> FROM AQUEOUS SOLUTIONS

Karen Lee  
Spring Valley High School

Biosorption is a process used for the removal of trace levels of contaminants from industrial effluents. Copper, a major contaminant, can be a public health hazard when it pollutes sources of food and water. Orange peels have high adsorptive capacities because of the composition of polar functional groups that increase adsorption potential. The purpose of this study was to determine whether monovalent or divalent metal cations would be more effective in modifying the orange peel biosorbent to increase biosorption rates. It was hypothesized that the orange peel biosorbent with the CaCl<sub>2</sub> modifications would have the highest adsorptive removal of copper from the water. The experiment was accomplished by transferring KCl modified, CaCl<sub>2</sub> modified, and untreated orange peel biosorbents in copper solutions. Reaction rates were obtained by the application of differential rate laws to determine zero-, first-, or second-order kinetics for each treatment. The results were

statistically analyzed using one way analysis of variance (ANOVA) tests at  $\alpha=0.05$ ,  $F(2, 6) = 348.14$ ,  $p < 0.001$ , revealing significant difference between the biosorbent treatments. The post-hoc Tukey tests showed each organism had a different level of efficiency on the adsorption of the copper from the aqueous solution. The most effective of the three different biosorbents was the biosorbent modified by  $\text{CaCl}_2$ , which had a rate constant of  $1.3 \times 10^{-2}$ , which was the highest rate constant of the three rates. Therefore, the  $\text{CaCl}_2$  modified orange peel biosorbent was most effective at removing  $\text{Cu}^{2+}$  ions from an aqueous solution.

#### EFFECT OF ALUMINUM SULFATE AND MONTMORILLONITE ON THE FLOCCULATION OF CYANOBACTERIAL BLOOM

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Eutrophication and the growing algal blooms including cyanobacterial blooms are increasing environmental problems that threaten the safety of water activities and drinking water sources of developing countries. The purpose of this study was to find a better flocculant for reducing cyanobacterial bloom by comparing the flocculation efficiency of montmorillonite and aluminum sulfate. It was hypothesized that the aluminum sulfate would decrease the percent absorbance of chlorophyll-a the most at a concentration of 700 mg/L. There were 30 trials for each of the concentrations, 100 mg/L, 300 mg/L, and 700 mg/L, for the two flocculants, montmorillonite and aluminum sulfate. There were two types of control, one with just cyanobacteria with distilled water, and the other with just the concentration of flocculant without cyanobacteria. The flocculation efficiency was calculated by subtracting the final from initial percent absorbance of chlorophyll-a, measured by a spectrophotometer at the wavelength of 550nm. An ANOVA test determined that there was a significant difference among the absorbance of different concentrations of flocculants,  $F(5,174)=60.52$ ,  $p<0.001$ . Using a Tukey post-hoc test, it was determined that aluminum sulfate at the concentration of 700 mg/L was significantly different from the three concentrations of montmorillonite and had a higher mean overall than all five other treatments. Therefore, the hypothesis that the aluminum sulfate at the concentration of 700 mg/L would decrease the percent absorbance of chlorophyll-a concentration of cyanobacterial bloom by the greatest amount was supported.

#### THE EFFECT OF CAFFEINE ON THE SPEED OF MICE THROUGH A MAZE

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Caffeine is purported to enhance performance because it supposedly can give a final boost when participating in a sustained physical activity, and recent ads for certain caffeine based drinks, mainly energy drinks, present the illusion that when consumed, one becomes faster. Some ads imply that speed and energy can be present for a period of time after caffeine consumption. The purpose of this project was to explore the effect of caffeine on the speed mice run through a maze. Although mice are different from humans they are often used as test animals for relating to human subjects. The hypothesis is if the mice are timed both with and without caffeine then their times with caffeine will be faster. The null hypothesis is if the mice are timed both with and without caffeine there will be no difference in their speed. This experiment was done over 2 and ½ weeks in 5 class periods with 3 mice. On day 1 the mice ran the trial runs to allow them to get adjusted to the maze, and become comfortable in the environment. On day 2 mouse 1 and mouse 2 ran their timed runs without caffeine. In the next class period being day 3, mouse 3 ran its 10 trials without caffeine. On day 4 mouse 1 and 2 ran the 10 timed runs with .01 grams of caffeine in their system. The final day (Day 5) mouse 3 ran its 10 timed trials with the caffeine in its system. The experiment resulted in the hypothesis being supported the mice were able to maneuver the maze in a lesser time with caffeine than without.

#### THE EFFECTS OF POLYURETHANE, PORON® PERFORMANCE URETHANE, AND FORCEBLOC®HIGH-DENSITY POLYETHYLENE FOAMS ON THE REDUCTION OF A SOCCER BALL'S IMPACT FORCE

Andrew Levitt  
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The purpose of this experiment was to test how polyurethane, PORON® performance urethane, and ForceBloc® high-density polyethylene foams performed at reducing the impact from a dropped soccer ball in order to determine which material would be the best option to use in a protective helmet, which are worn to reduce the chance of concussion in soccer players. A soccer ball was dropped onto a Vernier Force Plate from a height of 4.27 meters, with different foams on top of the force plate to reduce the impact of the soccer ball. It was hypothesized that the polyethylene foam would perform the best since it was the most popular material for soccer headgears today. An ANOVA test was run with  $\alpha=0.05$  to see if there were any statistical differences between the performances of the different materials. There was sufficient evidence to reject the null hypothesis

that there were no differences between each of the foams  $F(3,116)=93.83$   $p<0.001$ . A post-hoc Tukey Test indicated that all of the materials were statistically different than each ( $p<0.05$ ) other, excluding the PORON® Performance urethane foam and the control of no protective material, which were the same ( $p>0.05$ ). The high-density polyethylene foam, which was statistically different than all of the other materials ( $p<0.05$ ), proved to be better than its contenders at reducing impact force.

#### NATURAL LEADING EDGE VORTICES ON *ACER DIABOLICUM* BLUME INSPIRED WIND TURBINE BLADE

Martin Li  
Spring Valley High School

The purpose of this study was to determine which of four wind turbine blade designs was best at producing the highest voltage. The blade designs used were the National Renewable Energy Laboratory (NREL) S83X Series consisting of three airfoils (STND): the S833, S834, and S835, a design resembling an *Acer diabolicum* Blume samara (M1), a design resembling an *Acer diabolicum* Blume samara with leading edge vortex generators (LEVoG) spaced 1mm apart (M2), and a design resembling an *Acer diabolicum* Blume samara with LEVoG spaced 4mm apart (M3). Because of the increase in number of LEVoG, it was hypothesized that the M2 design would produce the highest voltage. The four subscale wind turbine models were randomly tested on a generator in a Paxton Wind Tunnel for thirty trials each. It was found that the M1 blade design produced the highest voltage. An ANOVA test found significant differences,  $F(3, 112) = 128.03$ ,  $p<0.001$ . A post-hoc Tukey test found significant differences between M1 and the other three wind turbine designs. In conclusion, because the design of a wind turbine blade is a major component of a wind turbine, these results recommend further research in blade designs resembling an *Acer diabolicum* Blume samara to enhance the volts generated.

#### THE EFFECT OF PLAYING VIDEOGAMES ON THE COMPREHENSION OF NEW VOCABULARY

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Recently, there has been an increase in the average amount of time spent playing video games by American students. This has raised many questions on how this increase affects students' abilities to comprehend and learn new information. The purpose of this experiment was to determine how playing video games after school affects how well students are able to comprehend new vocabulary words. It was hypothesized that playing a video game in between studying new vocabulary and taking a test on the words would affect the comprehension of the new words in a negative way. The method of conducting this experiment was to separate students of almost equal cognitive abilities into two groups. The two groups were: the video game playing group, group 1, and the math problem working group, group 2. After the students were separated, they began to study thirty, made up English vocabulary words. The students studied the words for 20 minutes before beginning the second stage. Group 1 played MarioKart on a Wii entertainment system for 10 minutes while group 2 worked on a math worksheet related to the distance formula for the same amount of time. After the 10 minute period, the two groups began to take the vocabulary test. Both groups used the same test, and there was a 15 minute time limit to complete the 30 question test. The results showed that group 2 performed slightly better than group 1 with a mean score of 24.5 as compared to a 25.3 mean score. These results appeared at first to support the hypothesis, but a t-test analysis showed that  $t(20) = 0.306$ ,  $p > 0.05$ . This showed that there was not a significant difference between the test groups.

#### THE EFFECTS OF UV RADIATION OF THE DEGRADATION OF CALCIUM OXALATE

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The purpose of this experiment was to test whether or not calcium oxalate was an effective protector of marble against acid rain degradation. Many studies have been done showing that it is the best protector that has been found to date, even better than many commercial products. It sometimes occurs naturally, and therefore, scientists thought to use it to protect marble against the effects of acid rain. The experiment was done to test whether or not calcium oxalate degraded in sunlight, because this would lessen its effectiveness in keeping monuments intact. The hypothesis was that the longer the sample is exposed to sunlight, the weaker the effects of the treatment will become, and more marble will be taken off by the acid rain. The marble was massed and treated with the calcium oxalate. Every day, the marble would get the appropriate amount of sunlight, and be treated with the acid rain again. After the testing period was over, the marble was washed, left to dry, and then massed again. The resulting masses were then analyzed to see if a particular group had lost the most mass over the treatment period. The p-value was 0.16 which was greater than my alpha value at 0.05, meaning that there were no statistical differences between my groups. This means that my original hypothesis was refuted, and the null hypothesis accepted, meaning that the effects of the calcium oxalate do not wear off as the chemical is exposed to the sunlight, making it an effective protector of marble against the harmful effects of acid rain.

## PHYSIO TEX TAPE VS KINESIO TEX TAPE: A COMPARISON OF ELASTIC PROPERTIES

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This experiment was designed to examine the properties of two different athletic tapes in order to determine which athletic tape (Physio or Kinesio tex tape) had the more elastic properties. To complete this experiment a device was built that could pull the tape apart at an equal force each time the test was performed. The device was also able to pull the tape an equal distance each time. Before the test was performed an 18-centimeter piece of tape was measured and inserted into the device. After the test was performed, and the tape had been stretched, it was removed from the device, and measured again to see how much it stretched, as a matter of the elasticity. This lab was filled with many trial and error experiments to create a device that would accurately measure elasticity. The device has to hold the tape without slipping off, pull evenly on both sides, and only pull up and down. Also, the device needed to be strong in order to pull the tape, because the tape is very difficult to stretch far, since the elasticity is like that of a human's skin. The Kinesio tex tape is a better known, and more advertised brand of athletic tape than the Physio tape. Kinesio tex tape will be more elastic than the Pysio tape, when the two tapes are put through elasticity tests. If the Kinesio tape is not more elastic then there will be no apparent difference between the elasticity of the two tapes. The results of the experiment supported that Kinesio Tex tape is more elastic than Physio tape.

## THE EFFECT OF WHOLE MILK ON THE SURVIVABILITY OF SODIUM HYPOCHLORITE BY *SACCHAROMYCES*

*CEREVISIAE*

Jamie Mayson

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The purpose of this project was to determine how high of a concentration of sodium hypochlorite, or bleach, could one survive with little or no damage to cells. Milk was chosen because the fatty acids in milk help to protect the stomach's lining and it is suggested by many health sites, such as Medline Plus, that, should one accidentally ingest bleach, to drink milk or water to dilute the liquid. The basic procedure was to dip small absorbent pieces of sterile paper into the different concentrations of sodium hypochlorite and run multiple trials for each concentration. Each concentration was a different part of my dependent variable. *Saccharomyces cerevisiae*, or baker's yeast was chosen because of the similarity between those cells, and that of humans. The Yeast was left to grow for at least one day. Once each concentration was used, the diameter of damage was measured in inches; these measurements were my independent variable. The results suggested that there was no statistical difference of the means between any concentrations below 10% bleach. This allows us to conclude that the data supports the hypothesis of a lower concentration equating to a higher survivability, and rejects the hypothesis that raising the concentration would cause no change in cell death.

## THE EFFECT OF EXPOSURE TO ULTRAVIOLET B RADIATION ON THE GROWTH OF *RAPHANUS SATIVUS*

Hannah McCall

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The buildup of pollutants, such as halons, chlorofluorocarbons, and methylbromide, in the atmosphere over several decades has caused depletion of the stratospheric ozone layer. The depletion of the stratospheric ozone layer allows ultraviolet radiation to enter into Earth's atmosphere. Ultraviolet B (UVB) radiation has a wavelength of 280-320 nm and is the only type of ultraviolet radiation that affects Earth's organisms. The purpose of this experiment was to find out how UVB radiation affects the growth of *Raphanus sativus*. It was hypothesized that the *Raphanus sativus* exposed to ultraviolet B radiation for a longer period of time would grow less than *Raphanus sativus* exposed to ultraviolet B radiation for a shorter period of time. The control group was not exposed to any UVB radiation. The other groups were exposed to UVB radiation for 12 hours per day for 1, 2, and 3 weeks. The growth of the *R. sativus* plants was measured by dry mass because dry mass is a measure of how much matter the plant itself has, not the water it retains. An ANOVA test  $F(3,116)=21.64$ ,  $p<0.001$  was conducted at  $\alpha=0.05$  on the data collected, followed by a tukey test. The tukey test showed that the only significant difference in the dry masses of the plants was between the control group and the other groups. So, exposure to UVB radiation causes the growth of the plants to decrease significantly. Therefore, this study indicates that exposure to UVB radiation inhibits the growth of *Raphanus sativus* plants.

MEASURE OF OPTICAL DENSITY FROM THE RELEASE OF CHLORHEXIDINE DIGLUCONATE FROM  
ANTIBACTERIAL-COATED PVC INTO PHOSPHATE-BUFFERED SALINE

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Governor's School for Science and Mathematics

This project seeks to address one of the main goals among healthcare providers, which is the prevention of infection in the patient due to surgery. One strategy to prevent infection is the coating of an antibacterial onto the various instruments and materials used in surgery. In this experiment, a coating protocol was used to coat three separate pieces polyvinyl chloride (PVC) with 1%, 2%, and 5% solutions of chlorhexidine digluconate. An uncoated piece of PVC served as a control. After washing and drying, each piece was immersed in a 3 ml of a 1X stock phosphate-buffered saline (PbS) solution allowing the chlorhexidine digluconate to release. The optical density of each solution was measured at six different wavelengths and certain time intervals during a 24-hour period. The optical density of a sample of the 1X stock PbS was also measured. The stock PbS showed an optical density that was significantly lower than that of the other solutions. The optical densities of the uncoated-PVC-, 1% coated-, and 2% coated-solutions were elevated from the optical density of the stock PbS, and were similar to one another. The optical density of the 5% coated-solution was higher than all of the other solutions. The results suggest that in all of the pieces PVC leeching had a significant effect on the optical densities. Only in one case did the chlorhexidine release have a significant effect on the optical density of the solution. This coating process and others like it could be used to prevent infections during and after surgeries.

THE EFFECT OF DIFFERENT WASH TREATMENTS ON THE RATE AND AMOUNT OF MOLD GROWTH ON  
SUPERMARKET STRAWBERRIES

Alexis McCullough

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Due to the fact that the average American does not get the allotted 5 servings of fruit per day, the nutritional value of fruit is becoming increasingly more dependent on the freshness of the fruit. Mold is one of the most common factors of decreased nutritional value of fruit. In this experiment, the rate and amount of mold growth on strawberries was observed on strawberries that had been washed with four different household and/or fruit cleansers (Lysol, Dawn Hand Soap, Simple Green, and Fit Fruit and Vegetable Wash) or water. The purpose of this experiment was to determine whether the cleanser used to wash the fruit played a part on the molding rate of the strawberries. The alternate hypothesis was that those strawberries treated with a wash will show less mold growth than those washed with water. The null hypothesis was that the strawberries washed with the cleaners would stay fresh for a period of time equal to or less than the strawberries washed with only water. Two tests took place and each test took about two weeks. During the tests, the strawberries were washed with their designated cleaner and placed on a stake in a styrofoam base. The first trial was run over the course of about a week, but the data was inconclusive due to the strawberries drying out. The second trial was run over the course of two-three weeks and provided conclusive data. Findings allowed for the rejection of the null hypothesis and the acceptance of the alternate hypothesis. Overall, the data displayed the lowest mold growth rate on the strawberries washed with Lysol.

STRATIFICATION OF RENAL EPITHELIAL NEOPLASMS USING SINGLE NUCLEOTIDE POLYMORPHISM [SNP]  
MICROARRAY ANALYSIS

Anne M. McDermott

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Renal epithelial neoplasms are the most common malignancies in adults constituting approximately 54,000 cases in the United States every year, with over 13,000 deaths yearly. The four major classes of Renal Epithelial Neoplasms, clear cell renal cell carcinoma, papillary renal cell carcinoma, chromophobe carcinoma and benign oncocytoma, each possess characteristic genetic aberrations that may be used to classify patients for diagnosis and prognosis. Single Nucleotide Polymorphism (SNP) Microarray analysis can be used in conjunction with pathologic histology data to confirm patient diagnosis. Additionally, SNP microarray can be used to detect markers of poor prognosis thus allowing for more effective patient care.

We retrospectively evaluated histology data for 36 patients with renal cell neoplasms and compared it with the microarray data. SNP microarray analysis was used to determine the genetic abnormalities in each case. Based on this data, we classified each case by histology and by microarray and assessed concordance. Additionally, we organized the cases based on the number of risk factors present in the surgical pathology data and observed trends of mutations occurring consistently in high-risk patients in order to determine the potential of these mutations as markers of poor prognosis.

Out of 33 cases, 82% had concurrent results from both histology and microarray; 6 cases showed discordance between the histology diagnosis and microarray diagnosis. Of these 6 cases, two were unclassified by microarray leading to an overall concordance of 88% for the cases that had characteristic genetic aberrations. Loss of chromosome 14q was associated with

three or more adverse risk factors identified by histology (Fisher's exact test:  $p=0.012$ ) and gain of chromosome 9p was suggested to be linked to an adverse prognosis (Fisher's exact test:  $p=0.08$ ). Overall, cases of renal epithelial neoplasms with 3 or more adverse risk factors had a greater number of genetic mutations detected by microarray.

The high concordance rate observed between histology and microarray diagnosis suggests that microarray analysis is a useful tool that can be used to classify renal epithelial neoplasms based on their genetic aberrations and can also be applied to confirm a diagnosis by histology. These observations are suggestive that -14 and -9p may be associated with a poor prognosis.

#### FLUOROPHORE SEPARATION AND FINDING CONCENTRATION IN MIXTURES OF RHODAMINE 6G AND FLUORESCENT BEADS

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Governor's School for Science and Mathematics

This research studied the relative intensities of rhodamine 6G and fluorescent beads in mixtures of different ratios using fluorescence spectroscopy. If the measured relative intensities corresponding to each fluorophore in specific mixtures reflected the ratios mixed, it was hypothesized that the two fluorescent molecules could be distinguished, and the concentration of each fluorophore could be found. To test this, four different ratios of 100 nM range mixtures were made, and samples of the mixtures were observed using a Time Correlated Single Photon Counting (TCSPC) system. Five trials were completed for each ratio. The lifetimes and intensities of the fluorophores were found by using the data fitted with a three component exponential decay curve in Origin 8.0 data analysis software. The data yielded a trend in which the intensities corresponding to the components of a specific fluorophore increased as the concentration of that fluorescent molecule was increased. This trend was consistent for an average of the trials for each ratio and for the trial that had the best fit with the decay curve. These results supported the hypothesis, meaning fluorescent molecules could be distinguished in mixtures and researchers could find the concentrations of fluorophores if the original mixture was known. Fluorophores are used as tracers and in cellular mapping, and if this research holds true, researchers could place two fluorophores into the cell simultaneously, saving time and money.

#### THE EFFECT OF CLIMATE VARIABILITY ON THE BREEDING PHENOLOGY OF THE WOOD FROG, *LITHOBATES SYLVATICA*

Ashley McGovern

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Climate change is a possible barrier to successful breeding events and distribution of species. To have a better understanding of the magnitude of the affect, scientists found it beneficial to study the range margins of certain species in which climate is hypothesized to be a limiting factor in the distribution of the species. The wood frog (*Lithobates sylvatica*) is one good indicator species because it has a wide distribution in North America with its southeastern most border in the Blue Ridge/Piedmont region of South Carolina. This southernmost portion of its distribution is geographically diverse with deep coves that bisect the landscape, potentially acting as climate refugia. Our group used existing wood frog calling (i.e., breeding events) data from USGS's NAAMP (North American Amphibian Monitoring Program) in the eastern segment of its range, and combined these with Climate Wizard data using ArcGIS to see if there were any correlations between temperature change and amphibian decline. We analyzed the variability in breeding phenology of the wood frog in comparison to the variability in temperature data from NOAA and Climate Wizard. If the range margin areas have more climate variability, the climate may be the factor prohibiting range expansion. Furthermore, if climate warming is occurring there may be a range retraction. Our results showed no significant correlation; therefore the number of Wood Frog calls was unrelated to the average change in monthly temperature. It is possible that because wood frogs are opportunistic breeders they just change the timing of their breeding.

#### DEVELOPMENT OF DISEASE-RESISTANT POPLAR TREES USING GENETIC ENGINEERING

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Forestry is increasingly harmed as organisms causing plant diseases mutate and mature with greater rapidity than genes in plants to disease resistance. *Populus* trees, grown for biofuel and wood pulp usage, have recently become negatively affected by the fungus *Septoria musiva*. This fungus causes leaf-spots and canker disease on infected poplar trees, resulting in significant loss of biomass. In order to tackle this problem, research needs to be developed to increase disease resistance of poplars via genetic modification. Through the *Agrobacterium*-mediated method of plant transformation, three fungal disease-resistance genes—laccase (*Lac*), oxalate oxidase (OxO), and antimicrobial peptide (ESF 39)—were transformed either separately, in pairs, or all together, into the poplar (*Populus deltoides*) genome. The aim of this research was to use polymerase chain reactions (PCR) and reverse transcription PCR (RT-PCR) to verify if the transformation events and the

expression levels of the transgenes in populus. The gel electrophoresis analysis demonstrated that the single gene, double genes, and combination of genes were all successfully transformed into the populus genome.

TRACKING THYMIDYLATE SYNTHASE: FLUORESCENTLY MONITORING A MODIFIED ANTIFOLATE DRUG *IN VITRO*, USING CLICK CHEMISTRY

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Thymidylate is a key component in DNA that controls cell life and cell death. Without thymidylate, DNA replication would not be able to occur. The enzyme thymidylate synthase (TS) catalyzes a chemical reaction which is the de novo source of thymidylate. Reductive methylation occurs when 2'-deoxyuridine 5'-monophosphate or dUMP is reduced to thymidine 5'-monophosphate dTMP using 5,10-methylenetetrahydrofolate (CH<sub>2</sub>H<sub>4</sub>folate) along with TS. Certain chemotherapeutics target TS because thymidylate is unique to that enzyme. The objective of TS targeted drugs is to inhibit the production of thymidylate, thus, inducing cell death. Raltitrexed (RTX), the drug used in this research, is classified as an antifolate, TS targeted drug. Click reactions occurs when an azide containing an R group combines with an alkyne also containing an R group to form a 1,4-triazole product. These specific reactions are known as copper catalyzed Azide-Alkyne cycloaddition (CuCAA) reactions. This research focused on determining which dye; Cy5 or FITC paired with which antibody; Cy5 or FITC, which produce the best results. The second objective of this research was to use click chemistry along with the drug RTX to track TS within the cells. Using the results obtained through confocal microscopy and FACS analysis, the optimum signal received came from using 1 $\mu$ M concentration of the Cy5 azide-dye paired with the FITC antibody, hence, the limit of detection was determined.

USING A VIRTUAL ENVIRONMENT AND SIMULTANEOUS LOCALIZATION AND MAPPING (SLAM) TO AID IN VISUALIZATION AND CONTROL OF A REMOTE PHYSICAL ROBOTIC PLATFORM

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The purpose of this project was to control a robotic system using both a mobile operating system and a virtual environment. An Android tablet was used an application to control the robot's movements with a touch-activated user interface. The Turtlebot, in turn, sends odometry data back to the Android tablet, where the application processes the data into three-dimensional coordinates (x-axis displacement, y-axis displacement, and rotation) and stores it into memory. The numerical coordinates of the Turtlebot, which assumes that the starting point is the origin, is then represented on-screen as a virtual Turtlebot. Adjusting the coordinates of the virtual Turtlebot directly changes the coordinates of the physical Turtlebot. This project also extended into 3-D mapping using SLAM (simultaneous location and mapping) with applications in search and rescue. A virtual environment known as Opensim provides an avatar of the robot that can be viewed by anyone with an Opensim viewer, such as Imprudence which was used for this experiment, and the IP address of the environment used. The odometry data mentioned above is sent to the Opensim server, which moves the avatar's coordinates to match that of the Turtlebot. The project was extended in the fall of 2012 to add SLAM capabilities. Its purpose was to project the Turtlebot's three-dimensional surroundings into the virtual world. The applications for the resulting system could be used to control robots in search and rescue operations, hostile environments, or other searches in inaccessible areas.

INTERLUEKIN-1 REGULATION OF RANK LIGAND EXPRESSION IN PREOSTEOBLAST CELLS

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Bone homeostasis is maintained by bone resorbing osteoclasts and bone forming osteoblast cells. Osteoclast differentiation is induced by the receptor activator of nuclear factor kappa-B ligand (RANKL), secreted by osteoblasts. Pathologic conditions, such as arthritis, are marked by both elevated levels of inflammatory cytokines, like interleukin-1 (IL-1), and bone loss. It was hypothesized that IL-1 may modulate RANKL gene expression in the bone microenvironment which results in osteoclast activation and bone destruction. Therefore, preosteoblast cells treated with IL-1 (0-20 $\mu$ g) for 48 hr were analyzed for RANKL mRNA and protein expression by real time RT-PCR and Western blot analysis, respectively. RANKL-luciferase gene reporter plasmid was transiently transfected into stromal/preosteoblast cells and treated with IL-1 to determine its effects at the gene promoter level. It was found that IL-1 stimulates RANKL gene expression in stromal/preosteoblast cells at mRNA and protein levels in a dose dependent fashion. RANKL expression in the presence of IL-1 and transcription inhibitor Actinomycin D indicates IL-1 does not prolong RANKL mRNA half life. Real time RT-PCR analysis showed that IL-1 does not prolong the RANKL mRNA half-life. Furthermore, IL-1 treatment significantly increased RANKL-Luciferase reporter gene activity in these cells. It was also found that IL-1 has no significant effect on the RANKL inhibitor Osteoprotegerin (OPG) mRNA

expression. Therefore, RANKL could be a potential therapeutic target to prevent bone loss under inflammatory arthritis conditions.

#### A COMPARISON OF EFFICIENCY BETWEEN COMPACT FLUORESCENT LAMPS AND INCANDESCENT LAMPS

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CFLs are said to be more than 75% efficient than incandescent bulbs because much less energy is needed to light the bulb. CFLs produce a low quality of light and that even the same wattage of incandescent bulbs produces more light than the CFL. This indicates that the electrical efficiency of the CFL bulb is most likely lower than stated by the manufacturer. It was hypothesized that CFLs would be less efficient than stated by manufacturer and less efficient against incandescent bulbs. The first group was CFLs (Compact Fluorescent Lamp) with a stated lumens value of 900 and watts value of 13. The second group was the incandescent bulbs with a stated lumens value of 800 and watts value of 60. The light produced was measured in lumens that was calculated from illumination (lux) per square meter from the lux value that was tested for 60 seconds and the average value was taken for each bulb. The watts were taken for 60 seconds at a 1 second sample rate for each bulb and the average was taken from each bulb. A t-test was conducted on both lumens and watts to determine if there was a significant difference between CFLs and Incandescent and their given efficiency. Compact fluorescent lamps ( $M = 38.917$ ,  $SD = 1.865$ ) showed a significant difference in efficiency,  $t(28) = -87.54$ ,  $p < .001$ . Incandescent lamps ( $M = 8.862$ ,  $SD = 1.386$ ) showed a significant difference in efficiency to the null of 15,  $t(29) = -24.26$ ,  $p < 0.001$ .

#### THE EFFECT OF A VARYING ANGLE OF ATTACK ON THE AERODYNAMICS OF WING DESIGNED TO PRODUCE THRUST BY FLAPPING

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The purpose of this research was to evaluate the drag on a *Clione antarctica* wing at different angles of attack in order to determine if it poses a viable alternative to other wing shapes in aeronautics. It was hypothesized that as the angle of attack increased, more drag would be exerted on the wing. This was tested by placing a model *Clione antarctica* wing inside of a wind tunnel at different angles of attack and measuring the amount of drag that was exerted upon the wing. The angles tested  $-5^\circ$ ,  $-2.5^\circ$ ,  $0^\circ$ ,  $2.5^\circ$ , and  $5^\circ$ . The results showed that the amount of drag exerted on the wing could be modeled by the cubic line  $y = 0.04214 + 0.01707x - 0.000056x^2 - 0.000085x^3$ , where  $x$  = the angle of the wing, so long as the angle being examined was within the experimental data set. The model returned an  $r$  value greater than .90, which supports the idea that it could be used for interpolation. A greater amount of research, however, would be required first. The null hypothesis that there was no variation between drag measurements at differing angles of attack was rejected after a One-Way ANOVA  $F(4, 95) = 297.91$ ,  $p < 0.001$ . Tukey tests detected variation in all comparisons.

#### THE EFFECT OF THE PARTICLE SIZE OF SODA LIME ON THE AMOUNT OF TIME IT TAKES FOR AN UNSAFE CARBON DIOXIDE LEVEL TO BE REACHED

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Jordan Motlong

Rebreathers are closed-circuit breathing systems that are growing in popularity as opposed to the open-circuit respiratory systems. The purpose of this experiment was to determine which size particle of soda lime allows for the longest amount of time before achieving scrubber-failure. This knowledge can be used to increase the duration of dives or fire rescue missions. It can also change the human outlook on what can be done underwater. It was hypothesized that the smaller the pellets, the longer it would take to reach scrubber-failure when the  $CO_2$  is being ran through the pellets. This would be due to the larger surface area for the gas absorption to take place. A scrubber was built out of PVC piping. A hose was attached to a hole in a cap in one end of the piping. A funnel was placed inside the piping in order to disperse the carbon dioxide gas evenly throughout the soda lime sample. A piece of filter material was placed in the funnel to prevent soda lime from entering the hosing. A window was built into the side of the piping using heated Lexan plastic and silicon glue to hold the window in place. The hose in the closed end of the apparatus was connected to an on/off valve attached to the carbon dioxide regulator. The regulator was attached to the carbon dioxide gas tank. The regulator was set to release gas at approximately 2 psi. The soda lime was then crushed using a mortar and pestle and then moved into Ziploc baggies for each individual trial where the air was evacuated and sealed. This is where each trial amount was kept until it was used in experimentation. Before experimentation, gloves, goggles, and a mask were put on to remain safe from harmful vapors. To begin experimentation, the trial baggies were emptied into the PVC chamber via the open end and the gas was turned on while simultaneously starting



the stopwatch. The gas was allowed to run until the soda lime turned a distinct purple color. Once the trial substance was a dark violet, the time was stopped and recorded. and water because the reaction of Carbon Dioxide and soda lime yields water. The mean amount of time required to reach scrubber failure decreases as particle size increases. Based on the data in this study, if divers decreased their soda lime particle size, they could dive for longer periods of time on the same load of soda lime. The hypothesis in this experiment was supported because the amount of time for the soda lime to lose effectiveness increased as particle size decreased.

A STUDY OF THE POLY(ACRYLAMIDE) HYDROGEL, THE POLY(2-ACRYLAMIDO-2-METHYLPROPANESULFONIC ACID) HYDROGEL, THE POLY(2-ACRYLAMIDO-2-METHYLPROPANESULFONIC ACID)/ POLY(ACRYLAMIDE) DOUBLE-NETWORK HYDROGEL, AND THE POLY(ETHYLENE GLYCOL)/GELATIN METHACRYLATE COMPOUND HYDROGEL

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The degeneration of articular cartilage, cartilage in joints such as the knees and the hands, is a prevalent problem. A potential way of solving this problem can be seen in hydrogels. Hydrogels are linked polymer chains that 99.9% of their weight can be given by water when water swollen. The purpose of this experiment was to find a suitable replacement for articular cartilage by testing the compressive strengths of different hydrogels. The hydrogels used in this experiment were the poly(2-acrylamido-2-methylpropanesulfonic acid) (PAMPS)/ poly(acrylamide) (PAM) double-network hydrogel, the PAMPS single-network hydrogel, the PAM single-network hydrogel, and the poly(ethylene glycol) (PEG)/ gelatin methacrylate (GelMA) compound hydrogel. These hydrogels were chosen because the PEG/GelMA compound hydrogel is known for its biocompatibility, while the PAMPS/PAM double-network hydrogel are known for their structural integrities. The hydrogels were prepared in eight-millimeter molds, and they were measured using the Bose machine at USC. The hydrogels were tested for compressive strength to represent their ability of the gel to withstand compressive forces.

THE EFFECT OF DIFFERING CALCIUM CHLORIDE CONCENTRATIONS ON THE DIFFUSIVE ESCAPE RATE OF CALCIUM ALGINATE HYDROGELS

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An increased demand in knowledge concerning therapeutic benefits of hydrogels in drug administration has caused for research dealing with the absorption and diffusion of solutions across gel membranes to focus primarily on alginates. The purpose of this experiment was to determine the effects of calcium chloride concentrations in the formation of calcium alginate on drug related diffusive properties. It was hypothesized that if the differing concentrations of 13%, 15%, 18%, and 20% calcium chloride were paired with sodium alginate, than the resultant calcium alginate with the highest calcium chloride concentration would have the lowest diffusive escape rate. Experimentation was conducted by mixing 6.5 grams, 7.5 grams, 9.0 grams, and 10.0 grams of calcium chloride in 50mL of water. The sodium alginate solution was then created by placing 4 grams of sodium alginate in 100mL of water. The calcium alginate gels formed by combination were cut into 1 gram increments for testing. A mL of normal saline/ ringer's solution was then injected into these 1 gram increments and weighed after injection and two minutes after injection to determine the diffusive escape rate. The control for the experiment was the 15% concentration most commonly used for calcium alginate formation. An ANOVA test showed that there was no statistical difference between the calcium concentrations for normal saline diffusion and ringer's solution diffusion ( $p$  value = 0.111) and ( $p$  value = 0.305) respectively. The study indicates no effect of calcium chloride concentration of calcium alginate on the diffusive permeability of hydrogels.

THE EFFECT OF COLOR ON PERCEIVED TASTE

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The purpose of this experiment was to determine whether or not color has an effect on the perceived taste of food. The hypothesis is that, if the color of the lemonade is changed, then a different taste will be perceived. The null hypothesis is that if the color of lemonade is changed, then there will be no taste difference perceived. The results of this project could be useful in providing background as for how certain foods can appeal to people, greatly impacting marketing and business strategies for food companies. This experiment was run by measuring out 1 gallon of lemonade into 4 pitchers. Coloring was then added. The lemonade within the pitchers was stirred, and then refrigerated until use. The lemonade was presented to test subjects in 1 ounce portions that were placed in 2 ounce disposable cups. For the first part, subjects tasted samples of lemonade while blindfolded, and for the second part of the trial the blindfolds were removed. The blindfolded part was used as a control to establish that there was no actual taste difference among the samples of lemonade with the color. The results from the t-test of the blindfolded section gave a t-stat number of 0.11. The  $2\sigma = 0.24$ , and because .11 fell between -0.24 and 0.24, the null hypothesis must be accepted, stating that when test subjects had blindfolds, there was no statistical significance between the control and the treatment. The results of the t-test for the non-blindfolded portion give a t-stat of -0.84 and  $2\sigma = 0.28$ . The t-

stat value of -0.84 fell outside of the  $2\sigma$  range of -0.28 and 0.28 therefore the null hypothesis can be rejected, and the alternate hypothesis, that the color affects the perceived taste of food can be accepted. It is statistically supported that there is a greater than 95% chance that if someone was drinking lemonade that was colored red they would proceed as being sweeter than if it was not colored red.

#### THE EFFECT OF pH LEVELS OF THREE, SEVEN AND TEN ON THE AMOUNT OF FLUORIDE IONS RELEASED BY A FLUORIDE RELEASNG DENTAL SEALANT

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This experiment was performed to test the effect of a 3, 7, and 10 pH environment on fluoride ions released from a dental sealant. Since pH varies in food and drink, it could impact the effectiveness of fluoride releasing sealants, possibly lowering future tooth decay. An EXSTICK FL700 fluoride meter was used for the analysis of the fluoride ions and calibrated with a F-standard and TISAB reagent tablet. The range of detection was 0.10ppm to 9.99ppm. pH samples were prepared from distilled water, hydrochloric acid (HCl), and sodium hydroxide (NaOH). 15-milliliters of a specific solution were placed into a small test tube. The dental sealant was placed on a 7 mm circle, and then hardened using a tungsten halogen curing light. Five sealed circles were placed into each of the 20 test tubes. The control was the circles without the dental sealant. The concentration of fluoride ions was measured each day, for the next ten days in ppm. The data showed that a fluoride concentration was greatest in the basic solution, pH=10. An ANOVA one-way test showed that pH has a statistically significant impact on the concentration of fluoride ions in a solution. The hypothesis, which stated that the sealed disks placed in a pH solution of 10 would release more fluoride ions than the disks placed in the solutions with pH of 3 or 7 was accepted, and the null hypothesis was rejected.

#### PARTICLE DEFLECTION IN MICRO-FABRICATED CHANNELS CAUSED BY MAGNETIC FIELDS

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Micro-fabricated channels, or microchannels, can be used to observe the movement and deflection of microscopic particles. Using either magnetic or electric fields, these particles can be deflected within a channel. The amount of deflection is attributed to a number of factors, such as channel geometry, particle size, particle concentration, and fluid flow rate. This particular experiment utilized a straight microchannel, measuring at 2 centimeters in length, 400 micrometers in width, and 50 micrometers in depth, with an inlet and outlet reservoir on both ends. The microchannels were created with a soft lithography process utilizing poly-dimethyl siloxane, or PDMS. Magnetic fields were generated with a permanent magnet embedded approximately 1.2 micrometers parallel to the center of the channel. Diamagnetic polystyrene particles, measuring 10 micrometers in diameter, were suspended in EMG 408 ferrofluid. Pressure was then used to drive the flow of the ferrofluid to allow the particles to be deflected by the embedded magnet. An attempt was also made to use an electric field generated from electrodes placed in the inlet and outlet reservoirs to drive the flow but was unsuccessful. Using a microscope connected to a recording system, the particle movements within the channel were observed at different positions and flow rates. The particles were deflected towards the channel side farther away from the magnet, indicating magnetophoresis. These results matched with the expectation that particle deflection would be an inverse function of the fluid flow rate and that there would be more noticeable differences between slower speeds.

#### INCREASING USABILITY OF TIME-SERIES HEALTH AND FITNESS DATA TO MOTIVATE A PHYSICALLY INACTIVE AUDIENCE

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There is no cure for diabetes, but preventative measures can be taken to reduce the risk of diabetes such as exercise. The researcher worked with the startup company, EnduringFX, to develop the optimal method of presenting time-series health and fitness data to increase public participation in physical activity. Following previous research, three main aspects – value, comprehension, and visual appeal – were determined to impact the on-line fitness experience and to encourage user participation in physical activity. This study focused on how best to make exercise data easy to read on the go. Originally, it was believed that each of the three factors were equally important in affecting what motivates a person to continue working out. However, following consumer research, it was determined that in order to get more helpful information, multiple angles would need to be approached. Qualitative responses from the previous consumer survey pertaining to a couple of graphs were referenced by the researcher to help the company's User Experience Designer come up with a new graph that would address

issues brought up in the feedback. Through the second consumer survey, the goal was to determine what information people want to view first regarding their workout and preferred graphic elements. By adjusting prototype, the goal was successfully accomplished because people's motivation increased by 15% and certain factors that people value were determined such as: readability, simplicity, and availability of workout information relayed in units in which a person can easily measure accomplishments.

#### CLONING OF MARKER GENES FOR VIRUS-INDUCED GENE SILENCING IN *PRUNUS PERSICA*

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Virus-induced gene silencing (VIGS) is a tool for gene silencing in plants. Gene fragments were to be cloned which could be used as visual markers for VIGS when silenced in peach (*Prunus persica* [L.] Batsch). Visual markers are useful because they provide easy ways to observe successful gene silencing. Five genes were selected: the H subunit of Mg cheletase (PpCHLH) gene, a gene encoding RuBisCO small subunit (Ppa012123), the flowering locus T gene (Ppa012320m), twin of the flowering locus T gene (Ppa012369), and mother of the flowering locus T gene (Ppa012388). Silencing either of the first two genes has been shown to result in a visible conversion of leaf color from green to white in other species. The third gene is expected to produce early flowers on the peach, and the last two are to be tested and observed in order to understand what they do. For each gene, amplification primers were designed using predicted gene models from the sequenced peach genome (VI.0) and the NCBI Primer BLAST tool. After ordering the primers, each one was amplified from a template of peach cDNA using polymerase chain reaction (PCR). Presence of amplification products were checked by electrophoresis in agarose gels. Amplification products were then successfully coned by ligation into PUC118 and the ligated plasmids were used to transform *E. coli* cells and sequenced. The insert containing plasmids were isolated from *E. coli* and verified to contain target genes. Cloned sequences will then be inserted into VIGS vectors for gene silencing.

#### THE DIFFUSION OF *BACILLUS SUBTILIS* ACROSS NATURAL AND ARTIFICIAL FABRICS

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Variations of fabrics and cloth types are often used for different purposes ranging from casual wear to handling the most hazardous of materials. However, the most common method of bacterial or substance exposure happens through clothing. This experiment was conducted for the purpose of researching the inhibition of bacterial spread through the fabric. Our group hypothesized that the artificial bacteria would do the best job at preventing bacterial growth on the petri dishes.

Both artificial and natural fabrics were tested for allowed bacterial growth. The results of the artificial fibers, nylon and polyester, were then compared to that of the natural fibers, cotton and silk. With 3 trials per type of fabric and a control group using no fabric, the bacteria were cultivated over the same length of time in the same environment. Using 50 mL of diluted bacterial solution, 2mL of solution was dropped on to each type of cloth that covered Petri dishes containing nutrient agar. After allowing each of the Petri dishes to sit for 10 minutes, allowing the bacterial solution to seep through the fabric into the nutrient agar, all of the bacteria samples were placed in an incubator at 37° C for 48 hours. The incubator was also checked after 24 hours to ensure no problems occurred during the culturing of the bacteria. After the 48 hours elapsed, the bacteria samples were removed from the incubator and bacterial colonies (using a 10 cm by 10 cm grid) were counted by the square mm.

Somewhat predictably, the results suggest that nylon is the best inhibitor of bacterial growth by far. The results supported the hypothesis. Although no bacteria was cultured on the other side of the fabrics themselves, it allowed for an extension of the experiment by trying to see whether or not there was a correlation between the amount of strength needed to rip the fabrics, and the amount of bacteria that diffused.

#### PROTEASE ACTIVATED RECEPTOR-1 (PAR-1) STIMULATED SCHWANN CELL DEATH IS A RESULT OF APOPTOSIS AS DETERMINED BY TERMINAL DEOXYNUCLEOTIDYL TRANSFERASE DUTP NICK END LABELING (TUNEL)

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Studies have shown that PAR-1 activation results in decreased central nervous system myelination from a loss of oligodendrocytes. Although the cells responsible for peripheral nervous system myelination differ, it was hypothesized that since Schwann cells also possess PAR-1 and its activation could lead to cell death. PAR-1 has been shown to be activated by SFLLRNP, an amino acid sequence of a the tethered ligand by the protein Thrombin. Spectrophotometer assays used to assess cell number have shown that PAR-1 activation does result in fewer cells in comparison to untreated controls. However, since Schwann cells are mitotic (oligodendrocytes are not), it was not clear if the decrease was due to cell death or a decrease in proliferation. If the loss is due to cell death, then the number of apoptotic cells should increase. Cultured Schwann cells were treated with 3µM SFLLRNP (PAR-1 activator) or 1X PBS (control) for 24, 48, or, 72 hours followed by a TUNEL Assay. The results indicate that PAR-1 treatment decreased both time point and cell viability, but the factors were not synergistic.

At each time point, PAR-1 activated cells showed a significant increase ( $p < 0.05$ ) in apoptotic cells in comparison to their controls. In addition the number of apoptotic cells at 48 and 72 hours was significantly higher ( $p < 0.05$ ) than their respective 24 hour treatments. The results show that PAR-1 activation increases Schwann cell death by activating apoptosis and that this process begins as early as 24 hours following treatment with SFLLRNP.

#### THE EFFECT OF COMMON HOUSEHOLD LIQUIDS ON ABELMOSCHUS ESCULENTUS'S GERMINATION RATE

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The purpose of this experiment is to determine whether presoaking okra seeds in various household liquids such as water, white vinegar, bleach, ammonia, and lemon juice will have an effect on their germination rate. This study is beneficial to home gardeners and farmers who wish to speed up the germination process when planting seeds. Okra seeds were presoaked in 5 different household liquids: water, white vinegar, bleach, ammonia, and lemon juice. The sixth group of seeds was the "control" group and therefore, was not soaked in any liquid prior to planting. The seeds were then wrapped up in paper towels and placed in Petri dishes where they were watered once a day and checked on twice a day. The results of this experiment contained averages of all six liquids germination rates. Bleach had the highest germination rate, but after running an ANOVA test, it was determined that the differences in germination rate were not statistically significant. Therefore, the null hypothesis was accepted.

#### GLYCEROL'S EFFECT ON THE AMOUNT OF EXTRACTED LIGNIN IN THE PRETREATMENT OF CELLULOSIC ETHANOL

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Cellulosic ethanol is one alternate energy source that holds a promising advantage in the replacement of oil in machinery. This experiment observes the pretreatment, or the first step, in producing ethanol. Pretreatment involves breaking the bonds between lignin, hemicellulose and cellulose. It is important to break down the lignin because it holds together hemicellulose, which must also be broken to isolate the wanted cellulose (Ruben, 2008). Organosolv is the pretreatment method used in this experiment. Organosolv can be costly and the organic solvents, like butanol, used can be harmful to the environment (Bryce 2009). The purpose of this experiment was to determine an alternative to the organic solvents used in Organosolv. To achieve this glycerol was tested, along with the control group butanol, to see how much lignin could be extracted from *Triticum aestivum*. It was hypothesized that glycerol would be able to extract the lignin, but not as well as the control, butanol. This was hypothesized because butanol is an organic solvent and has been shown to dissolve hemicellulose. (Black, Hames, & Myers, 1998). Wheat straw was boiled in glycerol or butanol as a pretreatment to break the bonds of the lignin and set it apart from hemicellulose. The samples were then centrifuged and the absorbance values were measured using a spectrophotometer. An unpaired or independent t-test was performed to test for a significant difference in the absorbance values between the butanol and glycerol groups. No significant difference was found with the  $p$  value = 0.762. The null hypothesis was not rejected. Another independent t-test was performed comparing the amount of wheat straw the two groups could digest. A significant difference was found with  $p = 0.048$ , so the null hypothesis,  $\mu_1 = \mu_2$ , was rejected. Therefore, glycerol was able to digest more of the wheat straw since glycerol did not vaporize as fast as the butanol due to glycerol's hydrogen bonding and high boiling point.

#### A COMPARISON ON THE EFFECTS OF DIVALENT AND TRIVALENT CATIONS ON THE SWELLING PROPERTIES OF SUPERPOROUS HYDROGEL HYBRIDS IN A GASTRIC ENVIRONMENT

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Hydrogels are hydrophilic, crosslinked polymers which are water insoluble and have many pharmaceutical applications such as drug delivery, drug release, and others because of their swelling and biodegrading properties. Fast swelling, large swelling ratio, and surface slipperiness allow SPHs to swell rapidly and would be beneficial for gastric retention devices. The two most common forms for iron are Fe (II) and Fe (III), which share two and three electrons respectively. Controlling the degradation of hydrogels in a physical procedure seems to have displayed more advantages over a chemical or enzymatic procedure. Physical procedures include measuring mass, volume, density as well as the more sophisticated equilibrium mass swelling ratios and equilibrium volume swelling ratios. The purpose of this study was to compare the influence of a divalent or a trivalent cation on the swelling properties of superporous hydrogels in a gastric environment. This was conducted to see if there was a significant difference between using a divalent or a trivalent cation to make a hydrogel best suitable for the gastric environment. Also, developing an economically feasible, effective method to deliver drugs can result in an increased patient compliance. It was hypothesized that the divalent cation would show the greatest improvement in density, equilibrium mass swelling ratios and equilibrium volume swelling ratios simply because the sodium alginate has limitations to the

presence of trivalent cations when making a gel. Statistically, the most significant differences lied between the control and the Fe (III) cation. Because the major differences were between the control and the Fe (III), and the control showed higher swelling properties, this tends to show that Fe (II) resembled the control and therefore it had higher swelling properties than Fe (III); thus partially supporting the hypothesis.

#### NEURAL CORRELATES OF INCREASED AGGRESSION IN AN ANIMAL MODEL OF AUTISM

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Autism Spectrum Disorder (ASD) is a complex disease with high heritability characterized by impaired communication, impaired social interaction, restricted and repetitive behaviors, and aggression. Current knowledge suggests that the pathophysiological process is initiated by alterations in several critical genes affecting the development of neuronal circuits and synapse function. A gene recently associated with autism is NrCAM (Neuron-Glia Related Cell Adhesion Molecule. Mice are excellent models for studying social behavior, as they naturally live in large groups. To ensure individual and species survival, animals must identify their conspecifics and engage in gender and species specific social and reproductive interactions, while avoiding predators. In mice, communication within the animal group relies on the emission (scent marking) and detection of chemical cues. Chemical cues are perceived through chemosensory systems (olfactory system), processed through distinct neural pathways and trigger genetically programmed sets of behaviors and endocrine responses that underlie establishment of social hierarchy, mating rituals and parental care, or responses to predators. Anomalies in the perception and processing of social cues may induce abnormal social approach and aggression.

We performed a behavioral assessment of NrCAM-deficient mice and wild-type littermates. We found that NrCAM-deficient mice exhibit reduced interaction, increased aggression towards unknown conspecifics, and abnormal communication (urine marking). An analysis of neuronal activation in a circuit relevant to processing and response to olfactory cues (olfactory bulb, amygdala, bed nucleus of the stria terminalis) using immunostaining revealed differences in neuronal activation between NrCAM-deficient male mice and wild type male littermates exposed to conspecifics.

#### RETINOIC ACID SHIFTS THE SENSITIVITY OF FIBROBLASTS TO TRANSFORMING GROWTH FACTOR 2-INDUCED SMAD2 ACTIVATION

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Both retinoic acid (RA) and transforming growth factor  $\beta$  (TGF $\beta$ ) signaling are important for many cellular processes including proliferation, differentiation, migration and apoptosis (programmed cell death). These processes are important during embryonic development, maturation of tissues and in diseases such as cancer. While long-term transcription-based regulation of these pathways has been studied, little is understood how RA and TGF $\beta$  signaling interact on a short-term time scale, which reflects interactions that are independent of transcriptional effects. We examined NIH 3T3 mouse fibroblast cells and compared their response to isolated cells from embryonic day 12.5 (E12.5) mouse hearts using all-trans RA (atRA) and TGF $\beta$ 2. The status of TGF signaling was accomplished by analyzing activation (phosphorylated) of Smad2 using Western blots. In 3T3 cell cultures, treatments of RA alone had little to no pSmad2 activation. Through multiple experiments we found the optimum concentration of TGF $\beta$ 2 was 1.0 ng/ml and the optimum concentration of all-trans RA was 100 nM. In combination treatments with RA and TGF $\beta$ 2, the pSmad2 production was higher than RA alone, but less than TGF $\beta$ 2 treatments alone. Experimenting with the length of time 3T3 cell cultures were treated showed that over longer periods of treatment the effect of RA to influence pSmad2 production diminishes as compared to the control one hour treatments. Compared to E12.5 mouse heart cells in culture the effect in 3T3 cells was to enhance TGF $\beta$ 2-stimulated pSmad2 whereas in heart cells RA reduced the effect of TGF $\beta$ 2. This could be due to differences in confluency of the two cell cultures and we are currently analyzing this possibility.

#### THE EFFECT OF DIABETES, HYPERTENSION, AND DIABETES & HYPERTENSION ON LEFT ATRIAL SIZE

Guillermo Pineda

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Knowledge about health risks and illnesses are starting to reach out to new people and places, giving birth to new ideas, with some of those being hypertension and diabetes. The purpose of this experiment was to see how hypertension and diabetes affect the left atrial size of the heart individually and together to see how they impact it. It was hypothesized that patients with hypertension would have significantly larger sizes of the left atrium, while the left atrial size would not be affected in diabetic patients. The data collected for this experiment were obtained from the Lexington Heart Medical Center and the left atrial volume index was used as the test value. It was calculated by dividing the calculated left atrial size with the calculated

body surface area of the patient. The three factors were not statistically different,  $F(2, 79) = 0.69$ ,  $p = 0.504$ , rejecting the null hypothesis that patients with hypertension would have a significantly larger left atrial size than the other patients. The study indicates that all of the factors affecting the patient had a negative influence on their left atrial size, increasing its volume, making that person more prone to cardiovascular diseases and illnesses.

#### STRUCTURAL CHARACTERIZATION OF AMiC, AN N-ACETYLMURAMYL-L-ALANINE AMIDASE IN NEISSERIA GONORRHOEAE

Royal Pipaliya  
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*Neisseria gonorrhoeae* (*N. gonorrhoeae*) is a pathogen that causes the sexually transmitted disease, gonorrhea. The increasing prevalence of *N. gonorrhoeae* strains in conjunction with decreased susceptibility to antibiotics including third-generation cephalosporins complicates treatment of gonorrhea. As a result, there is an urgent need for new antigonococcal drugs. Only the  $\beta$ -lactam class of antibiotics remains as an effective treatment against *N. gonorrhoeae*. They work by targeting penicillin-binding proteins which catalyze the final steps of peptidoglycan synthesis and are crucial for the bacterial cell wall formation during cell division. Another enzyme, AmiC, an N-acetylmuramyl-L-alanine amidase in *N. gonorrhoeae*, is involved in cell division and is a potential target for future antigonococcal agents. Its C-terminal domain is responsible for peptidoglycan crosslink degradation during bacterial cell separation. A structural characterization of the C-terminal domain of AmiC was initiated using a combinatorial approach of nuclear magnetic resonance (NMR) and X-ray crystallography. The AmiC protein was also cloned into a SUMO vector, transformed into *E. coli*, expressed, and purified to > 95 %. The  $^{15}\text{N}$ -AmiC-CTD HSQC spectrum shows good peak dispersion and high resolution of > 95 % of the expected backbone amino acid protons. This indicates that the  $^{15}\text{N}$ -AmiC-CTD protein is a highly structured, monomeric, folded protein suitable for structural determination and characterization by NMR and X-ray crystallography. The preliminary data provides justification for more detailed studies of AmiC-CTD alone and in complex with its peptidoglycan substrates.

#### THE EFFECT OF ENDOCRINE-DISRUPTING BISPHENOL A ON THE SEX RATIO AND REPRODUCTION OF DROSOPHILA MELANOGASTER

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Bisphenol A (BPA) is a chemical commonly used in the production of polycarbonate plastics, which has been determined as an endocrine disruptor. The purpose of this study was to expose the fruit fly *Drosophila melanogaster* to varying concentrations of BPA and observe its effect on their reproductive success. It was hypothesized that fly populations exposed to higher concentrations of BPA would experience a shift in sex ratio and fewer offspring over three generations. Using Bisphenol A 97% powder, solutions were mixed with concentrations of 1.0 M,  $1.0 \times 10^{-1}$  M,  $1.0 \times 10^{-2}$  M,  $1.0 \times 10^{-3}$  M,  $1.0 \times 10^{-4}$  M, and no BPA, and added to the fly medium. The flies were counted for 6 days over three generations. Chi-square contingency tables were used to analyze sex ratio and a General Linear Model ANOVA was used to analyze the effect of treatment on fly populations at alpha equal to 0.05,  $F(5, 25) = 3.24$ ,  $p=0.022$ . A Tukey test showed a significant difference between the 1.0 M and  $1.0 \times 10^{-3}$  M treatments at  $p<0.05$ . The three highest concentrations of BPA rendered their flies unable to reproduce after the first and second generations. Sex ratio was not affected by the BPA. This supports that there was a significant decrease in the reproductive success of *Drosophila melanogaster* when exposed to 1.0 M concentration of Bisphenol A. This study increases the evidence that BPA can not only cause problems in human populations, but also has disastrous consequences for insect species.

#### THE EFFECT OF VARIOUS SENSORY STIMULI ON THE EMOTIONAL RESPONSES OF KINDERGARTEN STUDENTS AS INTERPRETED THROUGH DRAWING ANALYSIS AND COLOR USAGE

Surabhi Poola  
Spring Valley High School

Children tend to retain information better when they are alert and ready to learn. The purpose of this study was to understand which kinds of stimuli excited children the most. By understanding this, teachers can devise better methods of teaching children. Excitement was measured in terms of how many colors the children used in their drawings. It was hypothesized that any stimulation would cause the children to use more colors. The method of conducting the experiment was to expose the children to different stimuli, visual, olfactory, gustatory, somatic, and auditory, then allow them to draw a picture. Visual stimuli were presented in the form of slideshows. Olfactory stimuli were presented in the form of strips of

paper sprayed with a scent. Gustatory stimuli were presented in the form of food. Somatic stimuli were presented in the form of tiles covered with different materials. Auditory stimuli were presented in the form of clips of music. Children were given approximately five minutes to draw after exposure to the stimulus. During the control for this experiment, children were asked their favorite colors and given time to draw. There were no significant differences in the number of colors used by males,  $F(16,216)=1.43$ ,  $p=0.137$ . For females, there were significant differences between waltz and rough, grapes, vanilla, pastel, sour candy, rose, and smooth, and Choreography and grapes. Females used significantly more colors than males during waltz,  $t(28)=4.10$ ,  $p<0.001$ . Males used significantly more colors in the grapes treatment,  $t(25)=-2.56$ ,  $p=0.04$ . The hypotheses were not supported.

#### THE EFFECT OF THE SOIL DISTANCE FROM OAT ANTIFREEZE SOLUTION SOURCE ON SOIL MACRONUTRIENTS (PHOSPHORUS, NITROGEN, AND POTASSIUM) ALONG WITH SOIL pH

Heather Pusey  
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The purpose of this experiment was to explore whether there are statistically significant differences in the concentration of the macronutrients phosphorus, nitrogen, and potassium or the pH level of soil at 2 cm intervals away from an antifreeze source. It is important to be aware of antifreeze's effects on soil in case of a spill or uncontrolled disposal at the source and the distance away from the source. Two 9.5-gallon Rubbermaid storage containers were filled with soil and then an Organic Acid Technology (OAT) antifreeze solution, Zerex G-05, was poured into one of the storage containers and the other was used as the control. The soil containers were set into a fume hood for two days to allow the antifreeze to seep into the soil. Then, a false rainstorm was simulated using one quart of distilled water and a pegboard. The containers were placed back into the fume hood for one week for the surface to dry. Twelve soil samples were taken in 2 cm intervals from the antifreeze solution source to test the amounts of macronutrients and the pH level. This procedure was repeated five times to make six total trials. The data suggested that there was no statistically significant difference in the amounts of macronutrients at 2 cm intervals away from the solution source. However, there was a statistically significant difference in the pH levels of the soil at 2 cm intervals away from the solution source.

#### THE EFFECT OF A RECYCLED PAPER AGGREGATE ON THE TENSILE STRENGTH OF CONCRETE

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The purpose of this project was to determine the level of antioxidant properties in vitamins A, D, K, and E as measured by the oxidation levels in apples using Red Delicious apples as the indicator. The hypothesis was that if apple slices submerged in solutions of the vitamins A, D, K, or E, then Vitamin E will be the best antioxidant and keep the apples from oxidizing. Five Red Delicious apples were purchased and tablets of vitamins A, D, K, and E were purchased. The vitamins were crushed up with a mortar and pestle and mixed with distilled water. Apple Slices were soaked in the solutions for five minutes and then left to oxidize for thirty minutes. Afterwards, pictures were taken of each slice and uploaded into ImageJ® software. This software was able to detect the percentage of brown pixels in each image; helping to determine which apple had oxidized the most. These steps were repeated for all five trials. A new apple was cut and a new solution was made for each trial. It was concluded that vitamin K had the highest antioxidant property because apples submerged in vitamin K solutions were left the least oxidized. The data was averaged and analyzed using an ANOVA: single factor test. The results were statistically significant. Therefore the null hypothesis was rejected.

#### MOTIVATION IN RUNNING

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The drive that forces us to perform an action is motivation. Winning and exercising are both actions that thrive upon motivation. With motivation, more people will run and exercise in society, and the impetus to exercise will make people healthier and decrease obesity. In addition, coaches and personal trainers will know how to motivate the athletes. The purpose of the experiment was to find out what types of motivation encouraged middle school boys to win. Thirteen sixth grade boys were told to run a lap of 320 meters on a soccer field with different types of motivation. Accurate measurements were taken using a stopwatch. Weather on the day of the experiment was also recorded. Eight types of motivation were tested. Average times for each motivation for the subjects present were calculated. Positive extrinsic motivation, where the subjects were given homework passes, had 53.7 seconds and was the fastest and negative extrinsic, where a math test was distributed, came in last with 61.9 seconds. The control with no motivation was 59.9 seconds. Positive extrinsic motivation with tangible rewards was the fastest. Due to the age group of children being used, extrinsic factors play an important role in children. As age increases, intrinsic motivations increase in importance as extrinsic decreases. The famous psychologist Abraham Maslow created a pyramid of the hierarchy of needs. In the pyramid, Maslow did place intrinsic motivation over all forms of extrinsic,

but he probably only took into account adults. However, Maslow also placed social (popularity and acceptance) and esteem (self-worth/improvement) motivations over extrinsic as well. Also, parts of the brain put different individual values on different motivations. The children might have put more value on a reward since extrinsic factors are important as a child.

#### THE CORRELATION BETWEEN RESOURCE USAGE AND REGENERATION AND POPULATION SIZE USING COMPUTATIONAL MODELING

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The purpose of this experiment was to use a simulation model to investigate the dependence of populations on the availability of resources, on the degree of interaction between organisms in the population, and on initial population density. The sustainability of populations due to limitations in available resources and the resulting movement of organisms was a key component in determining the characteristics of the population. To conduct the experiment, a program was written in FORTRAN 77 based off of an earlier program, written for the preceding project. The program was iterated until stability of the population was reached. It was hypothesized that the fewer the resources that were available to the population, the more slowly resources regenerated, or the lower the initial population density, the more likely the population would be to crash and die off. It was also hypothesized that with more virulent disease, the more detrimental greater interaction between organisms would be; if disease was less of a factor, the less detrimental a greater degree of interaction would be. This was due to the fact that a greater range of interaction yielded a higher number of possible mates and a greater ability to relocate in case of resource depletion, but also made the rapid transmission of disease more possible. The data of population size over time was analyzed for several levels of each variable tested, and correlation tests were performed using exponential, Gaussian, hyperbolic, and hyperbolic tangent functions; resulting correlation coefficients supported the hypotheses.

#### FUNCTIONAL CHARACTERIZATION OF THE SOYBEAN E3 LIGASE GENE *GmSIZ1*

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SUMOylation, a posttranslational regulatory process in higher eukaryotes which modifies substrate proteins through the conjugation of Small Ubiquitin-related Modifiers (SUMO), has important functions in both animals and plants. In animals, the use of sumoylation was recently investigated in neuron cells, and found to function in protein to protein interactions. These interactions are crucial in neurons and glia, synapse information and various other neuronal functions. In plants, only the *Arabidopsis* and rice *SIZ1* genes, which code for E3 Ligase, were investigated recently. The genes were found to play a role in environmental stress relief. The purpose of this project is to functionally characterize *Glycine Max* (soybean) *SIZ1* (*GmSIZ1*) using protein subcellular localization, and a *GmSIZ1* promoter-GUS reporter system. To do this, soybean *SIZ1* gene encoding an 880-amino acid peptide and its promoter were cloned into E.Coli. Two binary vectors containing the *GmSIZ* protein fusing with *sGFP* for protein analysis, and the *GmSIZ1* DNA promoter driving GUS reporter gene for DNA analysis were constructed. As a result, two constructs were successfully made and then transferred into *Agrobacterium*. This was followed by transformation into *Arabidopsis*. *Agrobacterium tumefaciens* infects the plant and causes a tumor-like growth. Part of the constructed plasmids will integrate into the genome of the plant. Due to time constraints these transgenic plants will be observed to investigate the function of soybean *SIZ1* gene using fluorescent microscope and GUS staining technology, as future work.

#### UP-REGULATION OF L1CAM ISOFORMS BY TGF- $\beta$ IN CANCER CELLS

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L1 is a cell adhesion molecule that was originally found in the nervous system and identified as an important protein for normal neural development in humans due to its role in cell adhesion, neurite outgrowth, neuronal migration, and axon fasciculation. It has been shown to contribute to invasiveness and motility and is up-regulated in many cancers. Previous research has shown that transforming growth factor- $\beta$  (TGF- $\beta$ ) causes L1CAM to be up-regulated. L1CAM has two isoforms, a full-length form and a splice variant, which lacks exons 2 and 27. The aim of this research is to determine which isoform of L1CAM is up-regulated in the presence of TGF- $\beta$ . Two L1CAM-cell lines, MDA-MB231, a breast cancer cell line, and BXPC3, a pancreatic cancer cell line, were treated with TGF- $\beta$  for three days and ten days respectively. L1CAM expression in the treated cells was determined by quantitative real time polymerase chain reaction (qRT-PCR). A reverse transcriptase polymerase chain reaction (RT-PCR) was done to determine which isoform of L1CAM was up-regulated. Immunohistochemistry [FACS] was also carried out, exclusively for the cells treated with TGF- $\beta$  for ten days, to determine the localization of L1CAM. qRT-PCR results indicate that both cell lines show an up-regulation of L1CAM. RT-PCR results show



that the splice variant of L1CAM was up-regulated in both cell lines for the three and ten day treatments. Immunohistochemistry results showed the localization of L1CAM on the surface of the cells, indicating that functional L1CAM was up-regulated.

THE EFFECT OF VARYING CONCENTRATIONS OF PEPTONE ON THE RATE OF BIOREMEDIATION USING  
*PSEUDOMONAS FLUORESCENS* AND *BACILLUS SUBTILIS*

Philip Richardson  
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Scientists have found that using certain strains of hydrocarbonoclastic bacteria can help safely mitigate petroleum pollution and contamination by metabolizing the hydrocarbons present in petroleum. The purpose of this experiment was to determine what concentration of peptone caused the bacteria to grow the most and have the greatest absorbance value. This is an indirect measure of the bacteria's rate of bioremediation. Peptone concentrations of 0%, .5%, 1%, 1.5%, 2%, 2.5%, 3%, and 5% and the bacteria *Pseudomonas fluorescens* and *Bacillus subtilis* were used. It was hypothesized that if a 5% concentration solution of peptone were used for both *P. fluorescens* and *B. subtilis*, then there would be the greatest absorbance value. A total of 192 samples were tested, 96 inoculated with *P. fluorescens* and 96 inoculated with *B. subtilis*. Twelve samples were used for each of the eight concentrations listed above. The results supported the hypothesis. Two one way ANOVA tests were performed using an alpha value of 0.05. Both samples inoculated with *P. fluorescens*,  $F(7,88) = 743.13$ ,  $p < .001$ , and samples inoculated with *B. subtilis* had a significant difference,  $F(7,88) = 543.26$ ,  $p < .001$ . Next, two post-hoc Tukey tests at alpha value 0.05 were conducted. There was a significant difference between all of the *P. fluorescens* groups except between groups 1.5% and 2.5% as well as between groups 2.5% and 3.0%. There was a significant difference between all of the *B. subtilis* groups except between groups .5% and 1.0%, 1.5% and 2.0%, and 2.5% and 3.0%. This means that for the majority of the group, the addition of peptone significantly increased the bacteria's growth rate.

THE EFFECT OF A CERAMIC THERMAL-INSULATOR ON THE AIR-INTAKE OF AN  
INTERNAL-COMBUSTION ENGINE

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Many vehicles, such as cars, motorcycles, and boats are powered by internal-combustion engines. Although internal-combustion engines have been around for a long time, they are still very inefficient, losing most of the energy that they produce as heat. Until the internal-combustion engine is eventually replaced, it should be improved as much as possible. The purpose of this experiment was to try and improve upon technologies already used in many machines and vehicles. If the air entering an internal-combustion engine can be cooled, then air-compression can be made easier, causing better fuel economy. It was hypothesized that a ceramic thermal-insulator would reduce the temperature of the air-intake of an internal-combustion engine. In the project, a 2-cylinder spark-ignition internal-combustion engine was used. Three points on the intake manifold were chosen to record temperatures with U.V. temperature probes. The temperatures readings of these three points were recorded while running the engine both with and without a ceramic thermal-insulator present. Upon analysis, it was found that the ceramic thermal-insulator did not affect the air-intake temperature at the 1<sup>st</sup>  $t(33)=1.13$ ,  $p=0.134$  and 3<sup>rd</sup>  $t(39)=-3.14$ ,  $p=0.999$  points on the intake manifold, and the hypothesis was not supported. However, the hypothesis was supported at the 2<sup>nd</sup> point on the manifold  $t(37)=4.93$ ,  $p<0.001$ . In conclusion, the ceramic insulator did affect the temperature of the air at least partway through its journey through the intake manifold.

THE EFFECT RAISED CARBON DIOXIDE LEVELS IN SALT WATER ON THE OXYGEN PRODUCTION OF  
*BACILLARIOPHYCEAE*

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Increased carbon dioxide levels and lowered pH levels in the ocean have been shown to harm many marine organisms and stunt their biological functions. The purpose of this experiment was to test the effect of raised carbon dioxide levels in salt water on the oxygen production of marine diatoms. It was hypothesized that as the carbon dioxide levels of the salt water increased, and the pH decreased, the amount of oxygen produced by the marine diatoms, or *Bacillariophyceae*, would increase. 50 mL beakers were taken and filled with 30 mL of instant ocean salt water solution. The beakers were divided into groups of 15 for each pH treatment; the pH treatments were 8.1 (control), 7.9, 7.7, 7.5, and 7.3. The pH of the solution in each beaker in each group was lowered by bubbling the salt water with carbon dioxide and measured using a pH probe. 1 mL of marine diatoms was added to each beaker, and the beakers were left for 8 days in which the dissolved oxygen content was measured

using a probe every day for five days and on the last day. The general linear model showed a significant difference,  $F(4, 420) = 552.88$ ,  $p < 0.001$ , in the dissolved oxygen content of the different pH levels, and a gradual increase in the dissolved oxygen content as the pH lowered. Therefore, this experiment supports the hypothesis that as the carbon dioxide level increases and the pH decreases, the oxygen production of marine diatoms increases.

#### THE EFFECT OF HEAD POSITIONS ON REDUCING SOCCER CONCUSSION RISK

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Players can head a ball while keeping their head stationary; use a forward motion when heading the ball; or lean back then forward to strike the ball with their head. Players are taught that the more they move their head to the ball prior to impact the more control and velocity they will produce. Doing so may also lead to less impact on the head, as the forward movement will counteract the force of the ball. The purpose of this research was to test the effect of head movement on sport concussion risk in soccer. It was hypothesized that the greater the head movement the less acceleration will be incurred by the head. A field study was conducted using a dummy outfitted with a Vernier 3-Axis Accelerometer. Soccer balls struck the dummy's head under three conditions: no head movement, 10 degree head movement, and 20 degree head movement. The accelerometer measured acceleration incurred by the head when struck by an in-flight soccer ball. Analysis of variance (ANOVA) was used to test whether different amounts of head movement were statistically related to post-impact head acceleration. The ANOVA results support the hypothesis that greater head movement decreases post-impact head acceleration,  $F(2,33) = 5.306$ ,  $p < .01$ . Scheffé tests showed the no head movement condition mean was statistically higher than the 10 degree head movement mean,  $F(2,9) = 5.417$ ,  $p < .05$ , and the 20 degree head movement mean,  $F(2,9) = 9.831$ ,  $p < .01$ . These results empirically confirm that proper heading technique is an important factor in reducing soccer concussion risk.

#### THE EFFECT OF *RHIZOBIUM*, *PSEUDOMONAS FLUORESCENS*, AND *RHODOSPIRILLUM RUBRUM* ON THE REMOVAL OF NITRATE FROM WATER

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Nitrate pollution in drinking water has become increasingly dangerous over time. This nitrate is a result, mainly, from pesticides and fertilizers used in day to day farming. Research has been previously conducted to test how various materials helped in removing nitrate. The purpose of this experiment was to test how effect *Rhizobium*, *Pseudomonas fluorescens*, and *Rhodospirillum rubrum* are in removing nitrate from water. The hypothesis was that the bacteria *Rhizobium* would be the most effective. To conduct this experiment, three glass containers filled with 2.5L of .05M nitrate water were prepared. A plastic container holding soil that had bacteria already inoculated in it, was placed on a wire cradle in the container of nitrate water. A water filter was placed above the glass container, which allowed the nitrate water to flow through the soil and kept circulating. The bacteria were inoculated for twenty four hours before being tested. Each trial ran for twenty four hours and three trials went on at one time. The control for this experiment consisted of using soil with no bacteria inoculated in them. An ANOVA test was run on the percent decrease of the level of nitrate after being exposed to bacteria in each test group  $F(3,14) = 17.56$ ,  $p = .001$ . There was enough evidence to support the claim that there was a significant difference in the amounts of nitrate removed from each treatment. The Tukey test showed that there was a significant difference between *P. fluorescens* and the other two treatments.

#### AN ANALYSIS OF SCAPULAR POTTING TECHNIQUES USED IN A REVERSE TOTAL SHOULDER ARTHROPLASTY

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The Grammont reverse shoulder prosthesis has been shown to provide increased stability in patients with a torn rotator cuff or other joint damage. However, loosening of the glenoid component of the prosthesis is a common complication involved in reverse shoulder arthroplasty (RSA), which can result in improper healing. The purpose of this research was to develop a pottting procedure for mounting the scapular component of the prosthesis for future use in a dynamic testing platform to compare post-implantation micromotion between DJO Surgical, Exactech, and Tornier RSA designs. Alignment accuracy was measured in three planes: anterior-posterior (A/P), superior/inferior (S/I), and glenoid version (GV) using a MATLAB image analysis program. The average S/I baseplate tilt was  $-0.73^{\circ} \pm 0.41^{\circ}$  for Tornier,  $-0.25^{\circ} \pm 0.40^{\circ}$  for DJO, and  $-0.88^{\circ} \pm 0.41^{\circ}$  for Exactech. Transverse A/P tilt was  $0.63^{\circ} \pm 0.68^{\circ}$  for Tornier,  $0.42^{\circ} \pm 0.83^{\circ}$  for DJO, and  $0.50^{\circ} \pm 0.71^{\circ}$  for Exactech. Glenoid version was  $3.68^{\circ} \pm 3.86^{\circ}$  for Tornier,  $1.21^{\circ} \pm 2.32^{\circ}$  for DJO, and  $0.002^{\circ} \pm 2.72^{\circ}$  for Exactech. Maximum variation between specimens was found to be  $1.72^{\circ}$  for S/I tilt,  $2.22^{\circ}$  for A/P tilt and  $10.35^{\circ}$  for glenoid version. Differences between groups were

not statistically significant, though the angles should ideally have been zero. These differences can be taken into account during future tests to determine any secondary effects of the angles.

#### GANODERIC ACID- DM INDUCES APOPTOSIS IN T CELL LYMPHOMA

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Peripheral T cell lymphoma is a disease that has received less research attention over the years than other lymphomas. Current therapy includes the standard CHOP chemotherapy protocol and stem cell transplantation. These treatments are very toxic to patients and are not very effective long term. For these reasons, research has lately focused on natural plant extracts with less toxicity than standard chemotherapeutics. In this study, the effectiveness of a *Ganoderma lucidum* mushroom extract, Ganoderic Acid-DM or GA-DM, was examined. This lab has shown previously that GA-DM can induce apoptosis and autophagy in solid tumors. Through an MTS cytotoxicity assay it was determined that GA-DM displays dose dependent cytotoxicity to both human (Jurkat) and mouse (EL4) T cell lymphoma cell lines. Both cell lines displayed an  $IC_{50}$  toxicity of  $30\mu\text{M}$  of GA-DM and substantial killing at a reduced  $20\mu\text{M}$  concentration. Western blot analysis of GA-DM treated cells showed differential induction of apoptosis between EL4 and Jurkat cells as shown by Caspase 3 cleavage. Tetramethylrhodamine, ethyl ester, perchlorate or TMRE results supported this finding, showing that GA-DM treatment had little effect on EL4 mitochondrial integrity while it caused mitochondrial dysfunction in Jurkat. These data suggest that GA-DM may be inducing apoptosis in human T cell lymphoma while working through a secondary apoptosis pathway in mouse T cell lymphoma cells, possibly autophagy.

#### MINIMIZING PHEV EMISSIONS AND ENERGY CONSUMPTION USING CONNECTED VEHICLE TECHNOLOGY TO PREDICT SIGNAL TIMING AND SPEED PROFILE INFORMATION

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Conventional vehicles have caused an overreliance on oil that has led the automotive industry to search for alternative energy sources. This search motivated the development of plug-in hybrid electric vehicles (PHEV), which help to reduce fuel consumption. This research focused on the effects of PHEVs with predictive capabilities to minimize emissions and energy consumption in a signalized roadway network when signal timing information and speed profile data were transmitted to PHEVs in real-time. VISSIM, a micro traffic simulator, was utilized to model a portion of US93 in South Carolina. This model was calibrated and validated with real world traffic data. Three cases were tested. The base case simulated PHEVs without connected vehicle technology. The second case included PHEVs that received only signal timing data, but not the speed profile for the entire network. The third case simulated PHEVs that received the speed profile information in real time, but not the signal timing information. The cases were tested in the validated network and the second case, where signal timing information was given to the PHEV in real time, reduced fuel consumption by 49% as compared to the base case. The third case only reduced fuel consumption by 38%. Giving signal timing information to PHEVs in real time resulted in less fuel consumption than giving PHEVs speed profile information. Work is currently being done using the simulation developed in my research to determine the effects on fuel consumption if headway information is given to the PHEV in real time.

#### PHYLOGENETIC RELATIONSHIPS OF SIGNAL PEPTIDE PEPTIDASE AND RELATED PEPTIDASES IN SACCHAROMYCES CEREVISIAE

Pearl Sherly and Mathews Boddu

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Alzheimer's disease (AD) is the most common type of dementia that causes problems with memory, thinking and behavior. AD is caused by the accumulation of beta-amyloid ( $A\beta$ ) fragments cleaved by amyloid precursor protein (APP). In this process, APP is cut by two enzymes, beta secretase and gamma secretase. Presenilin, the subcomponent of gamma secretase, is responsible for cleaving APP through proteolysis. Thus, presenilins are considered therapeutic targets in AD. Recent studies show that presenilins, like signal peptide peptidases (SPP), are members of the aspartic-protease family of integral membrane proteins. They both have the ability to cleave substrate polypeptides within a transmembrane domain. Therefore, SPP is also considered a potential therapeutic target in AD. Previous research has shown that SPP is known to cleave a gene product YKL100C in *Saccharomyces Cerevisiae*. The aim of this research is to create a parallel model in yeast cells for AD. Growth curves of the YKL100C knockout mutant and wild types were carried out to see how growth patterns affect the gene. Blast searches were performed to look for homologues to determine evolutionary conservation. Results indicate the both the wild type and mutant grew at the same rate. Bioinformatics identified homologues in Humans, *Leishmania*, *Drosophila* and

Oikepleura showing that SPPs have been conserved proteins through evolution. Even though YKL100C looks like a non-essential gene, it may still play a vital role when cells are in distress.

#### COMPARATIVE ENCRYPTION/DECRYPTION TIMES AND ENCRYPTED MESSAGE SIZES OF AES, RABBIT, AND 3DES ENCRYPTION ALGORITHMS IN WEB BROWSERS

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This objective of this experiment was to determine the most efficient combination of encryption algorithm and compression sequence to secure messages in a web browser. Efficiency factors considered were the size of the encrypted message and the total time taken to encrypt, decrypt, compress and uncompress the message. It was hypothesized that if a message was first compressed and then encrypted using the Rabbit algorithm, then that would be the most efficient. The experiment was carried out by using Javascript and HTML to generate a large sample message and then applying the AES, Rabbit, and 3DES encryption algorithms one at a time. For each of these algorithms, the message was also compressed before and after the encryption to determine impact on efficiency. The encryption and compression sequence was executed iteratively to get 100 data points for each treatment. The data was inserted into an HTML table and analyzed by an One-way ANOVA test, along with a Tukey test. It was found that compressing messages before encryption resulted in significantly smaller size, but this did not vary significantly between different encryption algorithms. It was found that AES Compressed and Rabbit Compressed did not differ significantly in encryption time  $F(5,594) = 725745.7$ ,  $p < .0001$ . In measuring decryption time, AES Compressed Rabbit Compressed, and Rabbit Uncompressed did not differ significantly  $F(5,594) = 129438.12$ ,  $p < .0001$ . It was concluded that AES Compressed and Rabbit Compressed were the "best" encryption algorithms due to their quick encryption and decryption times as well as small size.

#### THE EFFECTS OF MOLYBDENUM BASED COMPOUNDS ON THE RATE OF ELECTROLYSIS OF WATER

Spring Valley High School  
Aakash Shingala

The purpose of this experiment was to find a cheaper, more effective catalyst for use in the electrolytic production of hydrogen for fuel cells. A common catalyst for hydrogen production and in fuel cells is platinum, which is the best catalyst of those used currently, but it is also very expensive. Another metal could be substituted for platinum if the reduction in cost outweighed the loss of performance. The viability of platinum could also be increased if an added compound could greatly increase the production of hydrogen. Molybdenum is one metal which is significantly less expensive than platinum and may be able to provide sufficient output for future use in fuel cell technology. It was hypothesized that the addition of molybdenum carbide would result in the greatest increase in gas production over the pure molybdenum. An electrolyzer was used to split the water. Tubes connected the electrolyzer to the bottom of two inverted graduated cylinders placed in a pneumatic trough filled with water. The cylinders measured the gas production. Two double A batteries were used as the power source and water, which contained different concentrations of molybdenum in the experimental groups, was added to the oxygen side of the electrolyzer. The electrolyzer was allowed to run for five minutes then the production of both hydrogen and oxygen was measured. An ANOVA test was run at an alpha level of 0.05 on both oxygen and hydrogen gas production and a  $p$  value of  $< 0.001$  was obtained. A Tukey post hoc test was then conducted to determine where the significant differences were. For both oxygen and hydrogen, the control differed significantly from the molybdenum test groups and the 0.5 M molybdenum differed from the 0.1 and 0.5 M molybdenum carbide groups. Based on this data the hypothesis that molybdenum carbide at 0.5 M would produce the greatest volume of hydrogen and oxygen was not supported.

#### THE EFFECT OF CRUSHED BROWN AND WHITE EGGHELLS EMBEDDED IN SOIL ON THE HEIGHT OF *BRASSICA RAPA*

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The purpose of this study was to see whether *Brassica rapa* plants attain a greater mean height with brown eggshells or with white eggshells. Eggshells contain calcium carbonate, which helps to regulate the pH of soil. It was hypothesized that the *Brassica rapa* plants provided with brown eggshells embedded in their soil would yield a greater mean height than the *Brassica rapa* plants provided with white eggshells due to the greater surface area of the calcium carbonate concentration. The experiment was carried out by having 30 plants in each of the three test groups. The test groups were the plants with brown eggshells, the plants with white eggshells, and the control, which had no eggshells. The plants were grown for 40 days, being provided with equal artificial light, water supply, and soil. The plants were carefully removed from their cups after the last day and their heights were all recorded. An ANOVA test was conducted to find out if there was a significant difference

between the three means;  $F(2.87) = 0.70$ ,  $p = 0.499$ . The null hypothesis was not rejected because there was no significant difference found between the mean heights of the test groups. The study did not show a significant difference in the heights of the plants using brown eggshells versus the plants using white eggshells.

#### DETERMINING FLUOROPHORE IDENTITY AND CONCENTRATION IN MIXED SOLUTIONS WITH LASER FLUORESCENCE SPECTROSCOPY

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Fluorophores are chemical compounds that have the ability to fluoresce, or to emit light after being excited by an energy source. Each of these compounds has a unique lifetime and can be manufactured to bind to specific molecules, making them easily identifiable and useful as probes, dyes, and reporters in many important biological applications including analytical fluorescent imaging and fluorescent tagging. There are numerous types of fluorophores, each with characteristics that must be understood before beneficial applications can be utilized. This experiment examines what occurs when two fluorophores are mixed together and the potential applications of fluorophore mixtures. It is hypothesized that if lifetimes are used to find the relative intensities of the components of a mixture solution, these relative intensities will show the concentrations of the different fluorophore components of the solution. Results supported this hypothesis, indicating that mixtures of fluorophores could be used to reveal the concentrations, as well as the identities, of molecules when used as reporter probes. Additional research is needed to explore the properties of mixture combinations of all the fluorophore varieties and to examine different subject environments, with the ultimate goal of using these mixture solutions in a cellular environment to find the concentrations of cellular components.

#### THE EFFECT OF HIGH SPIKED SALINITY LEVELS ON THE DEVELOPMENTAL RATE OF *ARTEMIA SALINA*

Grayson Stribling

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In this experiment, the survival rate of *Artemia Salina*, or brine shrimp as they are better known, was tested in parts per thousand levels of salt of 35, 39, 41, and 43 for short durations of time of 10, 15, and 20 minutes. The study was important because it examined one of the most salt-tolerant creature's ability to survive in the rising salinity levels of water due to global warming. It was hypothesized that if *Artemia salina* are exposed to short durations of elevated salinity levels, then the survival rate will be the highest in the parts-per-thousand level nearest their optimal living conditions. Over the course of one trial, a constant measurement of 5 mL of water containing shrimp was added to 12 petri dishes of 4 different salinity levels for three different time periods. After the designated time periods, the shrimp were then transferred to another container with their original living conditions. Analysis of the data showed that the survival rate was the lowest in the 20 minute time period and the 43 ppt level. A possible explanation for these findings would be that although these shrimp are accustomed to very high salinities, their ability to survive decreases if they have been raised in a less severe environment prior to their new environment. Further research may show at what exact time and salinity level they can live in comfortably.

#### ARTIFICIALLY CONSTRUCTED POLYMERS EXTRACT OIL FROM THE FEATHERS OF WATER FOWL AT A HIGHER EFFICIENCY THAN CONVENTIONAL METHODS

Casey J. Stevenson

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Oil spills are environmental disasters that effect entire ecosystems. However, the most highly affected organisms are avian inhabitants. These organisms rely on oceans and seas for their food source. When this source is contaminated by oil, they go fishing and are contaminated themselves. This contamination can cause illness, a need for rehabilitation, and in some cases death. A possible solution to this immense problem is oil absorbing polymers, specifically Enviro-Bond 403. It was hypothesized that the application of this polymer to contaminated feathers would drastically reduce the amount of oil in a less distressing process than is currently in practice. This was proven by testing seven groups of seven feathers using one of four methods (polymers, dawn dishwashing liquid, cat litter, and saw dust). The submersion time of the feathers was a constant two minutes. After the feathers were submerged in oil, one of the above listed techniques was put into practice. After this, each feather was carefully weighed and compared it to its original weight. Through this comparison the efficiency of the oil remover was discovered.

THE EFFECT OF TIME OF EXPOSURE TO UV RADIATION ON THE EFFECTIVENESS OF CHLORINE DIOXIDE AND IODINE WATER PURIFICATION TABLETS

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Among many people who use water purification tablets, there is a belief that a tablet will always work, no matter the circumstances or how the tablet was kept. If properly stored, a tablet will always prove effective in a necessary pinch. The purpose of this experiment was to test the effectiveness of water purification tablets after medium and long-term exposure to UV radiation. Of the two different kinds of tablets, it was hypothesized that the chlorine dioxide tablets would allow more bacterial colonies to grow, and would lose its effectiveness more quickly than the iodine tablets. This hypothesis was tested by exposing the different kinds of tablets to UV radiation, having them treat water from a nearby pond, and culturing bacterial colonies on agar plates. The number of colonies were counted and recorded. The experiment's control group was the trials of just pond water. This was done to make sure that the pond had bacteria to begin with. Two ANOVA tests were run at the 24 and 48 Hour Samples. Neither of them indicated significant difference, with  $(F(10,70)=2.08, p=0.05)$  at the 24 Hour Sample, and  $(F(10,70)=1.43, p=0.200)$  at the 48 Hour Sample. An ANOVA test indicated that there was a significant difference  $(F(10,70)=7.13, p<0.001)$ . A post-hoc Scheffé test indicated that the difference was between the 72-120 Hour Sample and between the control group and all the other groups. Therefore, the results of this study indicate that there is no significant difference in the effectiveness of differing times of exposure, and the two different kinds of tablets.

THE IDENTIFICATION AND ANALYSIS OF SOUTH CAROLINA'S FAILING INDUSTRIES AND THE CREATION OF A STATISTICAL FORECAST FOR THE STATE'S ECONOMIC RECOVERY

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This study aims to identify the demand conditions that could accelerate South Carolina's recovery out of the "Great Recession" that occurred from 2008 to 2009. By examining economic indicators such as Gross Domestic Product, wages, and, primarily, employment, failing industries were identified and evaluated against stronger versions of the same industry in other parts of the country. Through analysis of the discrepancies between the industries from location to location, it was found that the main debilitated sectors: Natural Resources, Construction, Hospitality, and Financial Activities are attenuated by the lack of demand in the housing and tourism industries. The results of this study state that the consumers of these industries can no longer contribute as easily to industrial growth because of their low monetary holdings after the many layoffs and cutbacks that occurred during the financial crisis.

PHOTODYNAMIC THERAPY OF *ESCHERICHIA COLI* WITH THE USE OF HEMATOPORPHYRIN, PURPURIN, AND ALUMINUM PHTHALOCYANINE CHLORIDE AS PHOTOSENSITIZERS

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Photodynamic therapy is a treatment that involves a photosensitizer and light; it can be used against cancer, microbes, and viruses. The purpose of this experiment was to test the antimicrobial effect of photodynamic therapy on *E. coli* using photosensitizers with varying amounts of time of light exposure. This was important because previous experiments do not go in depth about the comparison of classes of photosensitizers. It was hypothesized that the most effective photosensitizer would be hematoporphyrin because it is in the same class as most other photosensitizers and that the more time the bacteria were exposed to the light, the more would be killed. *E. coli* was treated with photosensitizers (no photosensitizer, hematoporphyrin, purpurin, or aluminum phthalocyanine chloride) and red light for 0 minutes, 10 minutes, 20 minutes, or 30 minutes. The change in absorbance of the *E. coli* was measured. A two-way ANOVA was run, showing that in the type of photosensitizer, there was a significant difference,  $F(3, 156) = 5.11, p = 0.002$ . For exposure to light in time, there was a significant difference,  $F(3, 156) = 47.47, p < 0.001$ . A significance was indicated in the interaction between both variables,  $F(9, 156) = 10.56, p < 0.001$ . The hypothesis was partially supported because in general, for the cultures with photosensitizers added, the change in absorbance of *E. coli* cultures decreased as the cultures were exposed to light for longer periods of time.

## EXAMINING THE ANTIBACTERIAL PROPERTIES OF GARLIC OIL, OREGANO OIL, AND GRAPE SEED OIL EXTRACTS ON MICROORGANISMS SIGNIFICANT TO WOMEN'S HEALTH

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Alternative medicine is the practice of using herbs and other unconventional methods as medical treatments. While not commonly tested by the scientific community, alternative medicine may prove as the solution to fight against new antibiotic-resistant bacteria and fungi. This research project investigated if oregano, garlic, and grapefruit seed oil extracts would have antimicrobial properties against the chosen bacteria and fungus. *S. aureus* and *P. aeruginosa* were cultured in Luria Bertoni (LB) broth and agar. *C. albicans*, was cultured in Sabourand dextrose (SD) broth and agar. All cultures were kept in incubator at 37°C during the experiments. Commercially purchased grapefruit seed oil, the garlic bulb or (*Allium sativum*) oil and oregano (*Origanum vulgare*) extract were used. After overnight incubation, the turbidity was adjusted to the absorbance 0.08 (at 625 nm) with sterile broth. A spread culture for each organism was made by using 40 ml of the culture. A sterile paper disc immersed in the extract was placed in the middle of the Petri dish. Zones of inhibitions were measured in *S. aureus* and *P. aeruginosa* plates after 24 hours of incubation, in *C. albicans* plates 48 hours following the incubation. A t-Test was performed to analyze the results. Our results show that Oregano oil extract and grapefruit seed oil extract showed antibiotic properties when used in *P. aeruginosa*, even though their effectiveness was not significant when compared to the two other antibiotic used ( $p > .05$ ). Garlic oil extract was ineffective against all three microorganisms used in our experiments. Oregano oil extract showed strong antibiotic properties when used against *S. aureus* and *C. albicans* ( $p < 0.001$ ). When oregano oil used against *C. albicans*, it inhibited growth completely. Oregano oil extract also showed strong antibiotic properties against *S. aureus* ( $p < 0.05$ ). The zone of inhibition caused by oregano oil was larger than the zones caused by all four antibiotics. Grapefruit seed oil also have antibiotic properties against *S. aureus* and against *C. albicans*. Its effectiveness against *S. aureus* nearly equal or stronger than two of the antibiotics used ( $p < 0.05$ )

## CHARACTERIZING MIR-218 AND ITS ROLE IN COLON CANCER METASTASIS

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Colon cancer is highly metastatic and therefore finding therapeutic methods are essential. One possible technique is using microRNAs to silence proteins involved in cancer thereby decreasing metastasis. The objective of this research is to determine the effect of microRNA 218 (miR-218) on the metastasis of human colon cancer as it is a regulator of ZEB2, a protein involved in cancer. Preliminary studies were done to determine the optimal transfection reagent, amount of transfection reagent, as well as the confluency of various colon cancer cell lines: SW 480, SW 620, colo 205, and colo 206F. The agents used were either a combination of synthetic RNA (si-glo) and Metafectene or si-glow and Lipofectamene. Images of the transfected cells were then observed for red fluorescence under the brightfield and fluorescence microscopes. Metafectene proved to be the most effective transfection reagent as seen by microscopy. In order to determine a migratory and invasive cell line, migration and invasion assays were done for the four cell lines used in the preliminary studies. The cells were starved and seeded onto the top well insert of the migration and invasion assay trays. Colo 206F cell line proved to be the most migratory. The colo 206F cells were then transfected under three different conditions: a) miR-218 - test; b) miR-200 – positive control; c) scrambled microRNA – negative control. The migration assays of the transfected cells proved to be inconclusive while the invasion assays of the cells transfected with miR-218 exhibited a decrease in invasive behavior.

## THE EFFECTS OF SULFATE AND CARBOXYLATE NANOPARTICLES IN COMBINATION WITH PENICILLIN ON ANTIBIOTIC RESISTANT BACTERIA

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Antibiotic resistant bacteria are an emerging public health and environmental issue. Common resistant bacteria found in industrial and hospital effluent are *E. coli*, *Salmonella typhimurium*, and *Staphylococcus aureus*. Penicillin, a widely used  $\beta$ -lactam antibiotic, has succumbed to penicillinase in many bacteria. Various nanoparticles have been studied for their antimicrobial properties; however, not much research has been done concerning nonmetal nanoparticles. The purpose of this experiment was to explore the antimicrobial properties of sulfate and carboxylate nanoparticles. It was hypothesized that using sulfate and carboxylate nanoparticles as drug carriers for penicillin would result in increased antimicrobial activity. For each type of bacteria, three setups were done: a control setup using only penicillin, a sulfate setup, and a carboxylate setup. Each was performed at two concentrations of nanoparticles: 2 $\mu$ l and 4 $\mu$ l. A zone of inhibition assay was performed for each treatment, and the diameters of the zones were recorded. An ANOVA test was done comparing the results of the treatments for each different bacteria at  $\alpha = 0.05$ : *E. coli*  $F(5, 12) = 30.03$ ,  $p = 0.000$ ; *Salmonella typhimurium*  $F(5, 12) = 26.5$ ,  $p = 0.000$ ; *Staphylococcus aureus*  $F(5, 12) = 3.73$ ,  $p = 0.028$ . Significant differences were found between the treatments for each bacteria, so a Tukey post-hoc test was conducted, which showed that the control treatments were significantly different from the nanoparticle treatments. The nanoparticle treatments, however, were not significantly different from each

other. Therefore, the hypothesis was supported and, as a drug carriage system, sulfate and carboxylate nanoparticles offer promising antimicrobial potential to combat resistant bacteria.

#### GROWTH OF CHLORELLA PROTOTHECOIDES IN BOTH REAL AND SYNTHETIC WASTEWATER FOR WASTEWATER TREATMENT AND BIOFUEL PURPOSES

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With an increasing focus on carbon dioxide and greenhouse gas emissions, alternate forms of energy are increasingly being sought out. One such method is the processing of microalgae into biofuel. In order to most efficiently produce the algae the growth process must be fully explored. It has been pointed out that wastewater could be a possible growth media, and wastewater treatment plants could be outfitted for algae production. The purpose of this study is to test the growth of algae in both actual and synthetic wastewater media to find out if this method is feasible. Four different cultures were prepared: anoxic, decant, synthetic anoxic, and synthetic decant. The anoxic and decant were both sampled from the Pendleton-Clemson regional wastewater treatment facility and simulate two separate stages of the treatment process. Synthetic media were made using the same organic and inorganic components as their counterparts. All of the cultures were spiked with *Chlorella protothecoides*. Preliminary results show that the decant is growing the most algae, while the anoxic and synthetic anoxic cultures are the most similar. Future plans are to carry out optical density tests for a few more days, and then test the cultures to see how the algae has removed nutrients from the original wastewater.

#### THE EFFECTS OF LEAD CONTAMINATED SOIL ON THE METAL ACCUMULATION OF *FAGOPYRUM ESCULENTUM MOENCH*

Sara Wallam  
Spring Valley High School

The purpose of this experiment was to research phytoremediation, a method of decreasing heavy metal concentrations in contaminated soils. Heavy metals were extracted from contaminated soils using phytoremediation. Hyperaccumulators are used for phytoremediation. In this experiment *Fagopyrum esculentum Moench*, buckwheat, was tested for phytoremediation. It was hypothesized that as the concentration of lead II nitrate in the soil increased, the lead accumulation would also increase. It was also hypothesized that *Fagopyrum esculentum Moench* was a hyperaccumulator that followed all requirements. In this experiment, *Fagopyrum esculentum Moench* was grown in soils with different concentrations of lead II nitrate. After a few weeks of growth, the shoots and leaves of the plants were prepared for lead testing. Samples of the shoots, leaves, roots and soils were made and were tested in a mass spectrophotometer at USC. The data was analyzed and used to determine the efficiency of *Fagopyrum esculentum Moench* for phytoremediation, the effects of the different soil concentrations on the metal accumulation, and whether the plant was a hyperaccumulator. From this data, two one-way ANOVA tests were conducted, and both null hypotheses were rejected because  $F(3, 21) = 1.11$ ,  $p > 0.05$  and  $F(11, 13) = 0.40$ ,  $p > 0.05$ . It was concluded that there was no significant difference between the six concentrations of lead II nitrate, so this part of the hypothesis was not supported. It was also concluded that *Fagopyrum esculentum Moench* followed all requirements and was a hyperaccumulator, so this part of the hypothesis was supported.

#### THE EFFECTS OF ULTRAVIOLET RADIATION ON THE PHOTOINHIBITION OF *ANABAENA*

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The purpose of this study was to evaluate the effects that Ultraviolet-light radiation has on photosynthetic inhibition of *Anabaena*. To examine this, similar cultures of Cyanobacteria were exposed to Ultraviolet Radiation for varying times of zero through four minutes. The amounts of Oxygen in parts per million were measured before and after the exposure to conclude how much of an effect the UVR was having per treatment. It was hypothesized that an increase in the time of exposure would result in an decrease in the amount of oxygen produced by the Cyanobacteria. A decrease in the amount of PPM oxygen production is equivalent to increase in photoinhibition. Data collected from 48 separate cultures indicated that there was a significant difference in the parts per million oxygen before and after for the differing minutes of exposure.  $F(4,43) = 4.98$ ,  $p = 0.002$ . The post-hoc Scheffe and Tukey tests were conducted and gave evidence that there was significance between all treatments. This study shows that increase in UVR exposure time may increase photoinhibition in *Anabaena*.



## THE EFFECT OF 1, 3, 7-TRIMETHYLYXANTHINE ON LIPID PRODUCTION IN *BOTRYOCOCCUS BRAUNII*

Andrew White  
Spring Valley High School

The purpose of this experiment was to determine the effect of caffeine on lipid production in the microalgae *Botryococcus braunii*. *Botryococcus braunii* presents an important untapped source of biofuels. The hypothesis was as the molarity of the caffeine increased, lipid production of the algae would increase. The method used to conduct this experiment entailed growing the algae in five 250 mL Erlenmeyer flasks, one with 200 mL distilled water and four with 200 mL of Modified Chu-13 media with the varying molarities of caffeine, 0.0, 0.0077, 0.042, and 0.072 molar. The flask containing the distilled water served as the negative control and the flask containing the Modified Chu-13 media with 0.0 molar caffeine served as the positive control. The algae were allowed to grow for two weeks. After two weeks the lipids were extracted from 5 milliliters algae and media using 3 mL of hexane, 2 mL of isopropanol and 3 mL of a 1.67 molar salt solution. The solutions were mixed together in a test tube and the uppermost hexane and lipid rich layer removed and quantified in milliliters. The data was analyzed using an ANOVA test at the  $\alpha=0.05$  significance level. The p-value was  $<0.05$ , therefore a Tukey test was then performed and a statistical difference was found between the negative and positive control groups. This indicated that caffeine decreased lipid production in the microalgae *Botryococcus braunii*, thus the hypothesis was rejected.

## THE EFFECTS OF QUERCETIN ON SKELETAL MUSCLE PROTEIN DEGRADATION AND OXIDATIVE CAPACITY IN MICE AFFLICTED WITH CHEMICALLY INDUCED CANCER CACHEXIA

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Cachexia is the unintended loss of 10% or more of a patient's body weight. Diet and nutrition are factors that may affect the weight loss associated with cachexia. Quercetin, a bioflavonoid compound found in fruits, is thought to be a possible treatment for cachexia. The purpose of this study was to determine the effect of quercetin on protein degradation and mitochondrial capacity in the muscle tissue of mice administered dextran sodium sulfate (DSS), which is a chemical that can induce colon cancer. It was hypothesized that mice administered DSS and quercetin would exhibit a decrease in muscle protein degradation and an abated loss of mitochondrial capacity in comparison to mice receiving DSS alone. The mice tested were all male. Quercetin was administered to one group through supplemented standard mouse chow beginning at nine weeks of age. At eleven weeks of age both experimental groups began DSS exposure in drinking water with 2% DSS for one week followed by two weeks of normal water. This cycle was repeated 3 times in total. There was no difference in the amount of food consumed by either group. The mean weight of the DSS + quercetin group's right gastrocnemius muscle was 138 mg ( $s=6$ mg) while the mean of the DSS group's right gastrocnemius muscle was 97 mg ( $s=14$  mg). This difference was shown to be statistically significant using a two tailed t test. The ubiquitination of muscle proteins and muscle mitochondrial capacity in mice administered quercetin and DSS with those only administered DSS was also tested. The protein content was examined using western blot analysis.

## THE EFFECT OF 475, 650, 300, AND 700 NANOMETER WAVELENGTHS OF LIGHT ON THE GROWTH RATE OF *SERRATIA LIQUEFACIENS*

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*Serratia Liquefaciens*, a bacteria in the family Enterobacteriaceae that is commonly used in experiments, was used to test the effect of colored light on the growth rate of bacteria. It was hypothesized that if *Serratia Liquefaciens* is grown under to 475, 650, 300, and 700 nanometer wavelengths of light, then their growth rate will be different from the bacteria exposed to white light. The null hypothesis is that if *Serratia Liquefaciens* is exposed to 475, 650, 300, and nanometer wavelengths of light, then their growth rate will be the same as the bacteria not exposed. After cultivating the bacteria, using the sterile and clamshell techniques, and covering the petri dishes in colored gels, the bacteria was then left in an incubator to grow. After twenty-four hours, the petri dishes were unwrapped and photos were taken of each dish. These pictures were then inputted into the software ImageJ where the percent of the dish covered by bacteria was calculated. This data was put into Microsoft excel and a z-test was run. An analysis of the data allowed us to reject the null hypothesis and accept the alternate hypothesis that exposure to different wavelengths of light has an effect on growth rate. The results of this project could be used to slow or speed up the growth of bacteria in controlled environments.

## THE EFFECT OF SHOT TYPE ON PELLETS INSIDE THE DEFINED TARGET AREA

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The purpose of this experiment was to determine if lead shot would have more pellets in a defined target area than steel shot at distances of 20, 30, and 40 yards in shot sizes of 4 and 6. During this experiment, both types of shot were fired and then the data were collected and analyzed. After firing, the targets, 22x28 cm poster boards, were digitized and the wholes made by the pellets were counted. The statistical center of the pattern was then found using Vernier's Logger Pro. The defined target area, a 50cm x 50cm square, was then generated based on the statistical center. The pellets inside the defined target area were then counted and the targets were compared to each other according to shot size and the number of pellets inside the shell. The data was then entered into Microsoft Excel and graphs were generated. It was determined that there were more pellets inside the defined target area for lead shot than steel shot in 5 of the 6 comparisons. There were a higher percentage of pellets out of the original number of pellets contained in the shell inside the defined target area for lead shot than steel shot in 4 of the 6 comparisons. Since only one trial was performed, there was not enough data collected to conclude that the data was statistically significant, although there were trends found. There was not enough data to support the hypothesis, but if there had been other trials tested that showed the same data as this trial, then the hypothesis could have been supported. The null hypothesis was not rejected.

## LOW-COST BLOOD GLUCOSE MONITORING SYSTEM WITH PRINTED ON-DEMAND TEST STRIPS FOR IMPLEMENTATION IN RESOURCE-POOR SETTINGS

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More than 285 million people worldwide are diabetic and require daily blood glucose monitoring. As glucometers have evolved, they have become more accurate (~3% variance), but test strips can be expensive for patients, especially those without health insurance. In addition, in developing countries that rely on donated medical supplies, matching meters and strips are not always available to patients. The goal of our project is to design a low-cost meter and strip system that can be used in resource poor settings when standard meters or strips are not available. Our strategy is to create test strips that may be printed on-demand by a standard inkjet printer. To print the enzyme, we used emptied color-ink cartridges. Glucose oxidase, horseradish peroxidase, and o-dianisidine dihydrochloride are inserted in the printing wells of the cartridge. These enzymes catalyze a glucose reaction whose final products elicit a color change. The enzymes are printed using a template in Microsoft Word. By varying the color in the templates, we can select the amount of each enzyme applied to the paper. To read the strips, we designed a low-cost glucometer using LED lights, a photodetector, and an amplifier that outputs the absorbance, which is processed by an Arduino microcontroller to determine the glucose concentration based on a standard curve. For proof of concept, the strips were tested using glucose solutions of varying concentrations (0-450 mg/dl). The absorption measurement was able to distinguish between glucose solutions with 25 mg/dl accuracy.

## THE EFFECT OF CHANGING ACID CONCENTRATION ON THE AMOUNT OF SILVER IONS (mg/L) THAT LEAK FROM SILVER INFUSED FOOD STORAGE CONTAINERS

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The purpose of this experiment was to determine if the acidity, or pH level, of a liquid stored in a silver infused food storage container affects the amount of silver (mg) that leaks out from the container. Eight silver infused bowls were each filled with solutions of various pH levels (2, 4, 6, and the control, water). These pH values are very similar to foods such as sauces, juices, and fruits. A Graphite furnace atomic absorption instrument was then used to analyze the results. The results showed that there was a statistical difference between the amount of silver that leaked out from each group with a different pH level. This experiment concludes that a more acidic solution does cause more silver to leak from the silver infused bowls; however, it is not enough leakage to be statistically different from a blank sample.

## THE EFFECT OF BODY WRAPS ON THE DECOMPOSITION OF BURIED MUS MUSCULUS

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This study is related to forensic science. It examined how various body coverings influenced the rate of decomposition for buried mice. There were eight mice in each testing group. One group received no body coverings, the second group received a cotton covering, and the third group received a plastic covering. They were all buried in potting soil inside protected

containers for 30 days and then dug up to be examined. The recovered bodies were then unwrapped and scored for total decomposition using the Megnesi Scale. The average decomposition score was 18.6 for the control group, 26.4 for the cotton wrapped group, and 11.6 for the plastic covered group. The Megnesi scale ranged from zero to thirty six. A higher score represents a greater decomposition rate. This research demonstrated that a body wrapped in cloth decomposes faster than a body wrapped in plastic, supporting the hypothesis stated. The results of this study have implications to the forensic science field, as it demonstrates that bodies buried in certain coverings can accelerate or slow the decomposition rate, therefore making it hard to estimate an exact time of death.

THE EFFECT OF CLAY PELLETS AND COCONUT COIR ON THE GROWTH OF *PISUM SATIVUM VAR. SACCHARATUM*

Leila Yazdi  
Spring Valley High School

The purpose of this project was to see which growing medium would be best for growing plants in a hydroponic setting. This project was conducted on *Pisum sativum var. saccharatum* plants using the four different mediums of clay pellets, coconut coir, water, and paper towels, to determine which medium produced the tallest plant. It was hypothesized that the clay pellets would produce the tallest plant. *Pisum sativum var. saccharatum* were grown in, 30 clay pellet and coconut coir trials and 15 water and paper towel trials. Plant heights were measured over a three week period. Coconut coir produced the tallest plants. The repeated measures ANOVA showed that there was no significant difference between the four mediums,  $F(3, 264) = 1.64$ ,  $p = 0.181$ . The p-value is less than the alpha value of 0.05, which means that there was no significant difference between the four mediums. It was also determined that the water medium had the lowest effect on plant growth. The second most effective growing medium for the *Pisum sativum var. saccharatum* was then determined to be the clay pellets, and the third most effective medium was the paper towels. This means that the clay pellets were not the most effective medium.

THE EFFECT OF ANTIBACTERIAL MEDICATION ON THE RESISTANCE OF BIOFILM FORMATION AND EXTRACELLULAR POLYMERIC SUBSTANCES PRODUCED FROM *STAPHYLOCOCCUS EPIDERMIDIS*

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Spring Valley High School

This study aimed to investigate possible combination treatments of rosin-based antibacterial medications on biofilms. Because the three-dimensional bacterial colonies are held together by extracellular polymeric substance (EPS), biofilms are typically highly resistant to antibacterial medications. The effect of rosin-based antibacterial medication was observed, in an effort to examine the relationship between different compositions of rosin-based medication and relative biofilm thickness ( $\mu\text{m}$ ). The results of this experiment may serve as a model that can assist in the removal of other biofilms, structures frequently produced by pathogenic bacteria as well as a number of other harmful organisms. It was hypothesized that rosin-based antibacterial medications would not promote the growth of bacterial communities. *Staphylococcus epidermidis* was used as the biofilm-forming organism. *S. epidermidis* biofilm samples were collected after 72 hours of incubation. The biofilm was treated with diluted antibacterial medications for 24 hours, a time period selected to mirror the human body's natural breakdown period for similar medications. One way ANOVA testing showed that there were statistically significant differences between three types of medications,  $F(3,16) = 15.523$ ,  $p = <0.001$ . The post-hoc test indicated the significant differences between medication 1 and medication 2, medication 1 and the control group, medication 2 and the control group, and medication 3 and the control group. The hypothesis was not fully supported by the experimental data and analytical statistics, since medication 3 is more effective than medication 2. The potential of rosin-based antibacterial medication inhibition of biofilm proliferation was investigated under limited domain, other chemically constructed bacterial medications or other forms of human metabolic secretion, such as human digestive enzymes, and human biofilm may be studied to further determine the behavior of human biofilm.

THE EFFECT OF MEDICALLY DIRECTED DIET AND EXERCISE MODIFICATIONS ON THE RISK OF PRE-DIABETES AND TYPE 2 DIABETES

Abbie Zvejnieks  
Spring Valley High School

The prevalence of obesity induced type 2 diabetes mellitus is increasing worldwide. The objective of this clinical trial was to investigate the impact of dietary and lifestyle modifications along with weight reduction on objective laboratory risk factors for type 2 diabetes. The clinical trial included 35 patients who enrolled in a physician directed weight loss program and 11 control patients. Objective laboratory analysis of fasting insulin, fasting glucose, low density lipoprotein (LDL) cholesterol,

body mass index (BMI), and systolic and diastolic blood pressure were performed before and after 8-10 weeks of intensive medically directed diet and lifestyle changes. Match controls had similar laboratory evaluations without dietary and lifestyle modifications. Results showed significant decreases in markers for type 2 diabetes including a decrease in fasting insulin of -11.87 IU/mL  $t(35)=-6.83$ ,  $p<0.001$ , a decrease in fasting glucose of -23.4 mg/dL  $t(35)=-2.92$ ,  $p=0.006$ , a decrease in LDL cholesterol of -21.5 mg/dL  $t(35)=-4.35$ ,  $p<0.001$ , a decrease in BMI of -4 kg/m<sup>2</sup>  $t(35)=-9.42$ ,  $p<0.001$ , a decrease in systolic blood pressure of -11.57 mm Hg  $t(35)=-9.22$ ,  $p<0.001$ , and a decrease in diastolic blood pressure of -12.49 mm Hg  $t(35)=-4.35$ ,  $p<0.001$ . In a cohort of highly motivated patients, it was concluded that intensive medically directed modifications of diet, namely a low glycemic whole food based diet, in concert with moderate daily exercise results in reversal of several risk factors for type 2 diabetes in patients with metabolic syndrome/pre-diabetes.

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