Abstracts for the 32nd Annual
Loudoun County Regional Science & Engineering Fair

March 14, 2013
Tuscarora High School

Sponsored by Orbital Sciences Corporation
Loudoun RSEF Categories
100 Animal Sciences
200 Behavioral & Social Sciences
300 Biochemistry
400 Cellular & Molecular Biology
500 Chemistry
600 Computer Science
700 Earth & Planetary Science
800 Engineering: Electrical & Mechanical
900 Engineering: Materials & Bioengineering
1000 Energy & Transportation
1100 Environmental Management
1200 Environmental Sciences
1300 Mathematical Sciences
1400 Medicine & Health Sciences
1500 Microbiology
1600 Physics & Astronomy
1700 Plant Sciences

For detailed category descriptions visit the ISEF website at: http://www.societyforscience.org/isef/project_categories

Project Numbering
For exhibition, all projects are given a number. The first series of numbers indicates the category & project number. The letter represents the school. The last numbers indicate the student’s grade.
<table>
<thead>
<tr>
<th>Last Name, First Name</th>
<th>Project No.</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbott, Caroline</td>
<td>1201B10</td>
<td>Chemical Analysis of Paleo-Sediments From the Ecosystem of Extinct Sand Sharks</td>
</tr>
<tr>
<td>Abousaeedi, Ashkan</td>
<td>201W12</td>
<td>The effect of lunar phases on crime rate</td>
</tr>
<tr>
<td>Aceron, John Tyler</td>
<td>901J10</td>
<td>The Impact of Different Building Materials on Wi-Fi Signal Coverage</td>
</tr>
<tr>
<td>Aird, Justin</td>
<td>801T12</td>
<td>Using a Capacitor as a Lightning Rod to Deflect Lightning to a Place of Absorption as an Alternative Energy Source</td>
</tr>
<tr>
<td>Alam, Ayaan</td>
<td>1401W12</td>
<td>Investigating the Long-term Effects of Acetaminophen Use on Alveolar Epithelial Cell Gene Expression and Morphology</td>
</tr>
<tr>
<td>Alcantara, Jed</td>
<td>701W12</td>
<td>The effect of the variance in the low crested, submerged structure of a tsunami barrier on the horizontal inundation distance of a tsunami</td>
</tr>
<tr>
<td>Andersen, Scott</td>
<td>1701B12</td>
<td>Effects of Hydrogen Peroxide on Growth of Micro Greens</td>
</tr>
<tr>
<td>Armstrong, Katherine</td>
<td>1501D10</td>
<td>The Effect of Juglone on Micrococcus luteus</td>
</tr>
<tr>
<td>Armstrong, Lara</td>
<td>1401W12</td>
<td>Investigating the Long-term Effects of Acetaminophen Use on Alveolar Epithelial Cell Gene Expression and Morphology</td>
</tr>
<tr>
<td>Awasthi, Shriya</td>
<td>1702F12</td>
<td>The Phytoremediation and Sequestration of Acetone in Spathiphyllum</td>
</tr>
<tr>
<td>Babbitt, Michelle</td>
<td>1202C10</td>
<td>The effect of Eisenia fetida and Eisenia hortensis on effluent</td>
</tr>
<tr>
<td>Beard, Lauren</td>
<td>202C10</td>
<td>The Effect of Keyboard Layout on Typing Efficiency and Effectiveness</td>
</tr>
<tr>
<td>Bebek, Corinne</td>
<td>1001D12</td>
<td>Analysis of Boiler Room Energy Efficiency Using Ultrasonic Technology</td>
</tr>
<tr>
<td>Bellamah, Miranda</td>
<td>702D12</td>
<td>An Analysis of Coastal Landscape Degradation Patterns via Landsat Imagery</td>
</tr>
<tr>
<td>Betzner, Kristen</td>
<td>1703S10</td>
<td>The Effect of Allelopathic Interactions Between Triticum aestivum (Wheat) and Lolium rigidum (Rye) Seedlings on Each Other During Germination and Growth</td>
</tr>
<tr>
<td>Bhuiyan, Fariha</td>
<td>1704B09</td>
<td>The Effect of Color Variation on Phototropism</td>
</tr>
<tr>
<td>Bowen, Gentry</td>
<td>1402T12</td>
<td>The Effect of Heart Rate on Reaction Time</td>
</tr>
<tr>
<td>Bowman, Hannah</td>
<td>902C10</td>
<td>The effect of chlorine in swimming pools on swimsuit fabric durability</td>
</tr>
<tr>
<td>Breza, Katherine</td>
<td>1705V09</td>
<td>The Effect of Different Types of Light on Plant Growth</td>
</tr>
<tr>
<td>Broshekevitch, Cara</td>
<td>1101L12</td>
<td>A Future with no Landfills</td>
</tr>
<tr>
<td>Bundy, Austen</td>
<td>802F10</td>
<td>The effect of solar energy on the amount of radio waves transmitted over time.</td>
</tr>
<tr>
<td>Burcham, Joseph</td>
<td>1002B09</td>
<td>The Effect of the Amount of Sodium Chloride on the Rate of Electrolysis</td>
</tr>
<tr>
<td>Burns, Rachel</td>
<td>1301G11</td>
<td>Mathematically Modeling the Efficacy of Pertuzumab and Trastuzumab-dm1 when Used in Conjunction against HER2-Positive Breast Cancer</td>
</tr>
<tr>
<td>Byrne, James</td>
<td>1706H11</td>
<td>Which Media Type Promotes The Fastest And Longest Root Growth Of Vitis (Grape)?</td>
</tr>
<tr>
<td>Cain, Ami</td>
<td>1707C12</td>
<td>A Study on Prolonging the Shelf Life of Cut Carnations by the Addition of Calcium Nitrate to the Conditioning Water</td>
</tr>
<tr>
<td>Carlton, Cassidy</td>
<td>101G12</td>
<td>Do Horses Have a Color Preference?</td>
</tr>
<tr>
<td>Cassidy, Kaitlin</td>
<td>102C10</td>
<td>The Effect of Hoof Distortion on Equine Lameness</td>
</tr>
<tr>
<td>Chavez, Maria</td>
<td>1502C10</td>
<td>The Effects of Various Pesticides on the Quality of Potomac River Water and Quantity of Bacteria</td>
</tr>
<tr>
<td>Name</td>
<td>Code</td>
<td>Title</td>
</tr>
<tr>
<td>--------------------</td>
<td>------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Chea, Paula</td>
<td>301W12</td>
<td>The Effect of Natural Oils on Cyclooxygenase-2</td>
</tr>
<tr>
<td>Cheedella, Sourabh</td>
<td>1601S12</td>
<td>Using Kerr-Newman Approximations to Retrodict Subatomic Particle Masses</td>
</tr>
<tr>
<td>Choo, Alyssa</td>
<td>1102S09</td>
<td>The Effect of Phytoremediation on the Reduction of Nitrate Levels in Water.</td>
</tr>
<tr>
<td>Chowdhury, Abhilasha</td>
<td>103S09</td>
<td>The Effect Of Antioxidant Enriched Herbs On The Fertility Rate Of The Drosophila melanogaster Exposed To UV-C</td>
</tr>
<tr>
<td>Chugg, Gillian</td>
<td>1403D12</td>
<td>Does Vitamin B6 Alleviate Chemotherapy Effects</td>
</tr>
<tr>
<td>Colbert, Daniel</td>
<td>1708B10</td>
<td>The Effect of Different Concentrations of Bay Laurel Leaves' Juice on Killing Dandelions</td>
</tr>
<tr>
<td>Colyer, Dalton</td>
<td>1003C10</td>
<td>Efficiency of Primitive Fire-Starting Methods</td>
</tr>
<tr>
<td>Coppens, Emily</td>
<td>104T11</td>
<td>Does Exposure to Dog Parks Influence Dog Behavior?</td>
</tr>
<tr>
<td>Corso, Andrew</td>
<td>203T12</td>
<td>Are a Majority of Teenagers Addicted to Social Networking Sites?</td>
</tr>
<tr>
<td>Coughlin, Rachel</td>
<td>1103C10</td>
<td>The Effect of Redistributed Food Items on the Amount of Food Waste in Schools</td>
</tr>
<tr>
<td>Cross, Olivia</td>
<td>1709T12</td>
<td>The Effect of Salt Soil Stress on the Osmotic Pressure Of Plants</td>
</tr>
<tr>
<td>Cunningham, Jacob</td>
<td>1203C10</td>
<td>Toxicity of Asphalt Sealants on Daphnia</td>
</tr>
<tr>
<td>Curran, Tyler</td>
<td>1602S09</td>
<td>The Effect of Temperature on the Flight of Baseballs</td>
</tr>
<tr>
<td>Dao, Uyen My</td>
<td>204V10</td>
<td>Total Recall</td>
</tr>
<tr>
<td>Das, Shivani</td>
<td>1204S10</td>
<td>The Effect of the addition of calcium carbonate on the restoration of pH of an acidified body of water and the survival rate of Daphnia magna</td>
</tr>
<tr>
<td>Davidson, Andrew</td>
<td>1603T12</td>
<td>Is the Current Accepted Formula for the Force Behind an American Football Hit Accurate?</td>
</tr>
<tr>
<td>Davis, Kaelin</td>
<td>803W12</td>
<td>Prosthetic Hand</td>
</tr>
<tr>
<td>Day, Leah</td>
<td>1503D12</td>
<td>The Effect of SlgA in Breast Milk on Escherichia coli Biofilm Formation</td>
</tr>
<tr>
<td>Deason, Stephanie</td>
<td>1604C09</td>
<td>Are Geodesic Domes Stronger than Gable Roofs?</td>
</tr>
<tr>
<td>Desantis, Allison</td>
<td>302P09</td>
<td>The Effect of Lactose and Glucose on Yeast Fermentation</td>
</tr>
<tr>
<td>Devilla, Kimberly</td>
<td>205T12</td>
<td>The Effects of a Romantic Relationship on Academic Performance and Self-Esteem</td>
</tr>
<tr>
<td>Divi, Pranathi</td>
<td>303S12</td>
<td>The Efficacy of Various Reagents on Inhibition of Beta Amyloid Oligomerization in Transgenic Caenorhabditis elegans</td>
</tr>
<tr>
<td>Donovan, Adam</td>
<td>1004D12</td>
<td>The Effect of Various Shaped Solar Concentrators on the Efficiency of Solar Energy Output</td>
</tr>
<tr>
<td>Dorsey, Caroline</td>
<td>1504P10</td>
<td>Effects of Mouthwash on Bacteria</td>
</tr>
<tr>
<td>Downing, Kathryn</td>
<td>206G10</td>
<td>The Earworm Effect</td>
</tr>
<tr>
<td>Draper, Savannah</td>
<td>1205B10</td>
<td>The Effect of Wetland Placement on Polluted Water</td>
</tr>
<tr>
<td>Drennan, Nicholas</td>
<td>207V10</td>
<td>How Many Licks Does It Take to Get to the Center?</td>
</tr>
<tr>
<td>Est, Lauren</td>
<td>105S09</td>
<td>The Relationship between Light and the Behavior of Drosophila</td>
</tr>
<tr>
<td>Fackler, David</td>
<td>1005B10</td>
<td>The Effect of Different Fin Configurations on the Altitude Achieved During Flight</td>
</tr>
<tr>
<td>Faulkner, Charla</td>
<td>208V10</td>
<td>The Effect of Music on Work Accuracy</td>
</tr>
<tr>
<td>Name</td>
<td>Code</td>
<td>Title</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Faulkner, Shannon</td>
<td>209V10</td>
<td>The Effect of Parents' Taste Preference on Students' Taste Preference</td>
</tr>
<tr>
<td>Fischer, Megan</td>
<td>703C10</td>
<td>Determination of Sources Areas for Clasts within the Leesburg Member of the Balls Bluff Formation</td>
</tr>
<tr>
<td>Fleming, Lia</td>
<td>1404D12</td>
<td>Energy Conservation via Pose Running Technique: A Therapeutic Exercise Strategy for Musculoskeletal Disorders</td>
</tr>
<tr>
<td>Francis, Audrey</td>
<td>106F11</td>
<td>Investigating the Effect of Biochanin A on Ivermectin Resistance in C. eleg</td>
</tr>
<tr>
<td>Frawley, Jenna</td>
<td>1505D12</td>
<td>The Effect of Microenvironment Complexity on the Speed of Antibiotic Resistance Acquisition</td>
</tr>
<tr>
<td>Fricke, Danielle</td>
<td>104T11</td>
<td>Does Exposure to Dog Parks Influence Dog Behavior?</td>
</tr>
<tr>
<td>Froelich, Mitchell</td>
<td>210D12</td>
<td>Imagined Consumption Habituation Effects on Actual Food Consumption: A Dietary Strategy</td>
</tr>
<tr>
<td>Fuentes-Amaya, Gisela</td>
<td>204V10</td>
<td>Total Recall</td>
</tr>
<tr>
<td>Gillis, Gabrielle</td>
<td>1605C10</td>
<td>The Effect of Different Phone Models on the Amount of Radiation Emitted</td>
</tr>
<tr>
<td>Godman, Kelsey</td>
<td>1710B10</td>
<td>The Effect of the Light Cycle on the Biomass of Bioluminescent Dinoflagellates</td>
</tr>
<tr>
<td>Goldbeck, Lauren</td>
<td>1405D12</td>
<td>The Relationship Between Retinol and Stem Cell Differentiation after Embryonic Retinal Damage of Danio rerio (Zebrafish)</td>
</tr>
<tr>
<td>Gonzalez Araujo, Jonathan</td>
<td>1706H11</td>
<td>Which Media Type Promotes The Fastest And Longest Root Growth Of Vitis (Grape)?</td>
</tr>
<tr>
<td>Goriparthi, Abhishek</td>
<td>704W11</td>
<td>Earthquake Simulation &amp; Seismic Resistant Building Design</td>
</tr>
<tr>
<td>Grecco, Emma</td>
<td>1403D12</td>
<td>Does Vitamin B6 Alleviate Chemotherapy Effects</td>
</tr>
<tr>
<td>Harmon, Helena</td>
<td>1206P10</td>
<td>Testing Nitrites and Nitrates in Virginia’s Water Systems</td>
</tr>
<tr>
<td>Haro, Alex</td>
<td>1506V10</td>
<td>The Effect of Hand Sanitizer, Soap, and Water on Bacterial Growth</td>
</tr>
<tr>
<td>Harrigan, Colin</td>
<td>501J09</td>
<td>A Comparison of Levels of Lactose in Types of Milk</td>
</tr>
<tr>
<td>Hasan, Qasim</td>
<td>1207B09</td>
<td>The Effect of Limonene on the Recycling of Styrofoam Cups</td>
</tr>
<tr>
<td>Haugh, Mary</td>
<td>1606S10</td>
<td>The Effect of Different Finger Placement during a Swimmer’s Stroke on the Drag Produced</td>
</tr>
<tr>
<td>Hilado, Sarah</td>
<td>804T12</td>
<td>What is the Best Solution to Prevent the Collapse of Buildings Caused by Mechanical Resonance?</td>
</tr>
<tr>
<td>Hinchberger, Victoria</td>
<td>1406C09</td>
<td>The Effect of Ambient Temperature and/or Precipitation on the Total Number of Human Cases of W.N.V. (West Nile Virus)</td>
</tr>
<tr>
<td>Hoang, Chi</td>
<td>1507F10</td>
<td>The effect of natural acne treatments on the zone of inhibition of Propionibacterium acnes.</td>
</tr>
<tr>
<td>Hochstein, Alexis</td>
<td>107T12</td>
<td>A Comparison of Body Weight Between Koi Fish Treated with Melaleuca vs. Untreated</td>
</tr>
<tr>
<td>Hochstein, Michael</td>
<td>108C10</td>
<td>The positive photaxis of greater wax moths for different light bulbs</td>
</tr>
<tr>
<td>Hogarty, Joy</td>
<td>502V09</td>
<td>The Effect of Stain Guard on Carpet Stains</td>
</tr>
<tr>
<td>Hood, Katherine</td>
<td>903F10</td>
<td>The effect of the type of roof vent on the temperature of a house.</td>
</tr>
<tr>
<td>Hummer, Savannah</td>
<td>1607D12</td>
<td>Efficiency Analysis of MPO Canopus in the Plotting and Analysis of Trans-Atlantic Exoplanet Survey Data</td>
</tr>
<tr>
<td>Hutchison, Catherine</td>
<td>211J10</td>
<td>The Effect of Quantity of Facial Images Viewed on the Accuracy of Facial Recognition</td>
</tr>
<tr>
<td>Name</td>
<td>Number</td>
<td>Title</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>James, Esther</td>
<td>904P10</td>
<td>Effectiveness of Airbags in Preventing Fatalities in Vehicle Crashes</td>
</tr>
<tr>
<td>Janiga, Nicole</td>
<td>705F10</td>
<td>The effect of a manmade barrier on the strength of a rip current.</td>
</tr>
<tr>
<td>Jella, Jasmine</td>
<td>503S12</td>
<td>A Golden Opportunity to go Green</td>
</tr>
<tr>
<td>Johnston, Lindsey</td>
<td>1711L12</td>
<td>The effect of 290nm Wavelength UV-B Radiation Exposure on Phaseolus vulgaris DNA</td>
</tr>
<tr>
<td>Jones, Austin</td>
<td>1603T12</td>
<td>Is the Current Accepted Formula for the Force Behind an American Football Hit Accurate?</td>
</tr>
<tr>
<td>Jones, Matthew</td>
<td>1104C10</td>
<td>Algal Growth of Chlorella Algae in a Photobioreactor Under Various Lighting</td>
</tr>
<tr>
<td>Joyce, Jessica</td>
<td>401W12</td>
<td>Investigating the Roles of A2A and TrkB Receptor Proteins in Response to Cholesterol and Brain-derived Neurotrophic Factor (BDNF) in an Alzheimer's Disease (AD) Model</td>
</tr>
<tr>
<td>Keevey, Richard</td>
<td>1508W12</td>
<td>A Radical Spin on Water Filtration</td>
</tr>
<tr>
<td>Kesick, Ariel</td>
<td>1712D12</td>
<td>The Effect of Abscisic Acid on Phaseolus vulgaris (Kidney Beans) in Environmental Stress Conditions</td>
</tr>
<tr>
<td>Kidane, Sara</td>
<td>212T12</td>
<td>The Effects of Varying Work Efficiencies</td>
</tr>
<tr>
<td>Kirkpatrick, Andrea</td>
<td>109F11</td>
<td>Does the Barometric Pressure Affect the Amount of Food Consumed by Fish in Captivity?</td>
</tr>
<tr>
<td>Knox, Chloe</td>
<td>706C10</td>
<td>The Effect of Ocean Temperature on Hurricane Intensity</td>
</tr>
<tr>
<td>Konuri, Sahithi</td>
<td>1509W12</td>
<td>Fungal Inhibition In Dermatophytosis Using Herbal Treatments</td>
</tr>
<tr>
<td>Kurnos, Julianne</td>
<td>1208D12</td>
<td>Peroxide Delignification of Wood during Processing a Greener Chemical Method</td>
</tr>
<tr>
<td>Kurup, Sanjana</td>
<td>1006B12</td>
<td>Varying Phosphorus Concentrations and Extraction Procedures in Lipid Quantification of Scenedesmus quadricauda</td>
</tr>
<tr>
<td>Lee, Kayeon</td>
<td>504W12</td>
<td>The Effects of UV and LED Lights and Humidity on Acrylic Paintings</td>
</tr>
<tr>
<td>Lee, Lisa</td>
<td>304D12</td>
<td>The Fibrinolysis of Blood Clots during Thrombosis via Kimchi Extract</td>
</tr>
<tr>
<td>Lidwin, Jennifer</td>
<td>1209J09</td>
<td>The Effect of New Construction on the Beautification of Neighborhood Ponds</td>
</tr>
<tr>
<td>Littell, Allison</td>
<td>707C10</td>
<td>The Accuracy of Fitzroy's Storm Glass Compared to Modern Day Weather Forecasting</td>
</tr>
<tr>
<td>Littell, Emily</td>
<td>805C10</td>
<td>The Effect of Blade Length and Width on Energy Output of a Wind Turbine</td>
</tr>
<tr>
<td>Ludwick, Madeleine</td>
<td>1210V10</td>
<td>The Effect of Temperature Change on pH Level in Chesapeake Bay Water</td>
</tr>
<tr>
<td>Lunde, Mary</td>
<td>110P11</td>
<td>The Sense of Sight</td>
</tr>
<tr>
<td>Mack, Andi</td>
<td>1606S10</td>
<td>The Effect of Different Finger Placement during a Swimmer’s Stroke on the Drag Produced</td>
</tr>
<tr>
<td>Malhani, Talina</td>
<td>1713V09</td>
<td>The Effect of PH Level on the Growth of Phaseolus Lunatus</td>
</tr>
<tr>
<td>Maranan, Jazzmin</td>
<td>208V10</td>
<td>The Effect of Music on Work Accuracy</td>
</tr>
<tr>
<td>Marten, Carter</td>
<td>806C10</td>
<td>How Much Do Different Types of Lines Stretch Relative to Each Other?</td>
</tr>
<tr>
<td>Martin, Yolani</td>
<td>708F10</td>
<td>The effect of magnetic forces on how spherical masses move.</td>
</tr>
<tr>
<td>Mata-Chavez, Carlos</td>
<td>1714V09</td>
<td>The Effect of Worms on the Growth of Lima Beans</td>
</tr>
</tbody>
</table>
McGeady, Caehla 402D12 The Effect of the Protein Lactoferrin on the Production of CD19+ antibodies in B lymphocytes
McNabb, Christopher 1608C10 The Correlation of Camera Type to Performance Achieved in Capturing Colors
Membreno Mejia, Jonatan 1506V10 The Effect of Hand Sanitizer, Soap, and Water on Bacterial Growth
Menezes, Shannon 1609F10 The effect of different metal conductors on the rate at which a magnetic force is generated.
Meredith, Krysta 1302C10 The Prevalence of Natural Fractals and How Well They Can Be Modeled With a Computer
Merizian, Jacob 1007B09 The Effect of Different Concentrated Photovoltaic Designs on Electrical Output.
Mery, Nicole 1407P09 The Effects of Ethanol on the Development of Brine Shrimp
Miller, Alec 1105L12 Determining the Effectiveness of the Garden Cress Lepidium sativum as a Phytomediator for Aqueous Copper
Miller, Alexandria 1715L11 Comparing the Relationship of Aloe Leaf Length in Sand vs. Soilless Media
Mooney, Justin 505V10 The Effect of Mold Growth on Bread
Mooney, Ryan 502V09 The Effect of Stain Guard on Carpet Stains
Morales, Daniela 506J10 The Effect of Calcium Hydroxide Removal on the Amount of Phosphorus in Pond Water
Morales, Grace 403F11 The difference in protection by supplemental antioxidants and natural fruit antioxidants when exposed to oxidative stress.
Morsch, Robert 1008D12 The Enhancement of Wind Energy Production via Nitinol Wire Properties
Motazed, Nina 213V10 The Effect of Color on Taste
Muly, Olivia 507B09 The Effect of Sunlight on Ink Stability
Nekic, Garrett 1508W12 A Radical Spin on Water Filtration
Nelson, Mackenzie 111V11 Sugar Glider Tastes: What’s in Your Apple?
Newman, Kara 1211D12 Heavy Metal Filtration and Flocculation Using Banana Peels and Fruit
Nguyen, Trina 709J10 The Intensity and Frequency of Solar Flare Activity Over Time
Nueslein, Brianne 1303D12 The Foraging Behavior of the Zophobas morio Larvae as a Mobility Model of the Levy Walk
Ojeda, Madison 1716J09 The Effect of Non-Ionizing Radiation on the Germination and Early Growth of Phaseolus vulgaris
Olsen, Aubrey 1407P09 The Effects of Ethanol on the Development of Brine Shrimp
Olson, Rebecca 807F10 The effect of steel, pine timber, and brick on electromagnetic wave attenuation.
Olson, Savannah 1408J10 The Effect of Colorblindness on Afterimages
Oswari, Alexander 1409C12 The effect of Clove oil on Amyotrophic Lateral Sclerosis
Ouattara, Moustapha 508W12 The Effect of Extreme Heat on Metal Shell Casings and Fingerprint Visibility
Paek, Katrina 1410C09 The Effect of Various Types of Acids on Tooth Enamels
Palmer, Dagney 808T12 The Effect of Geometric Structure on Ion Propelled Aircraft Flight Height and Weight Capacity
Pandey, Sahan 509J10  The Effect of Sugar Coatings on Dissolving Time of Aspirin
Papazian, Alyssa 1510S12  The Efficacy of Allium sativum, Hydroxypropanoic Acid, Isothiocyanate, and Acetylsalicyclic Acid, Individually and in Synergy, on the Retardation of Biofilm Formation in Bacteria
Parkin, Emily 1717S10  The Effect of Gibberellic Acid Solution on the number of Root Nodules in Trifolium repens (white clover)
Payne, Caitlin 1714V09  The Effect of Worms on the Growth of Lima Beans
Paz, Rose 214D12  The Role of Visual Illusion on the Prevention of Falls
Pendley, Sara 1210V10  The Effect of Temperature Change on pH Level in Chesapeake Bay Water
Perara, Larissa 215W12  The Correlation Between Distance from Planned Parenthood Center, Education Attainment, Percent Employed, Population Density and Median Household Income with Pregnancy Rate in MD, VA, WV, DE, PA, and Washington, DC
Peruri, Alekhya 510B09  The Effect of the Type of Liquid on the Process of Electrolysis
Poehlman, Aristides 305D12  Optimal Temperature and Energy State for Tertiary Structure of Beta Dystroglycan Chain P
Pondugula, Pushpak 1212W12  The Effect of Liquid Type on Soil Absorption
Rahmani, Yasamin 1106D12  Creation of a Water Collector for Third World Countries via Namib Beetle (Stenocara gracilipes) Exoskeleton Design
Reed, Taylor 1511D12  The Effect of Temperature on the Presence of Bacteria in Pineapples
Richards, Anne 1101L12  A Future with no Landfills
Richardson, Olivia 112F10  The effect of different scents on distance Camponotus pennsylavanicus travel in 10 seconds.
Rillo, Miguel Lorenzo 511F10  The effect of different types of packaging on the amount of ascorbic acid in Pisum sativum (peas).
Ring, Samantha 1718F10  The effect of different pollutants on the growth and health of plants
Robillard, Rachel 216C10  Using Digital Photography, How Does Focal Length and F-stop Affect the Human Brain’s Ability to Properly Perform Pattern Recognition?
Rothacker, Eric 1610W12  Determining Object Shape with Acoustic Location
Rowell, Jessi 113C09  The Effect of Canis familiaris Paw Preference/Brain Lateralization on Performance
Royce, Trevor 1719D12  Turf Grass Growth and Drought Resistance via Rhizobium Slurry Seed Processing
Ryan, Elizabeth 505V10  The Effect of Mold Growth on Bread
Saikumar, Aishwarya 905W10  Determining if CF 680 Maleimide subjected to near infrared light can be used to kill tetrahymena pyriformis as basis for alternative cancer treatment
Samios, Elizabeth 808T12  The Effect of Geometric Structure on Ion Propelled Aircraft Flight Height and Weight Capacity
Schwartz, Daena 114V10  The Effect of Coca-Cola® on Daphnia pulex
Shah, Sarah 1713V09  The Effect of PH Level on the Growth of Phaseolus Lunatus
Shen, Kevin 906F10  The effect of monocot and dicot plants on the phytoextraction of salt.
<table>
<thead>
<tr>
<th>Name</th>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheridan, Kyle</td>
<td>207V10</td>
<td>How Many Licks Does It Take to Get to the Center?</td>
</tr>
<tr>
<td>Shufran, Christie</td>
<td>1512S10</td>
<td>The Effect of Photoreactivation on Reverting Ultraviolet Induced DNA Damage by the Monomerization of Pyrimidine Dimers</td>
</tr>
<tr>
<td>Siddiqi, Maha</td>
<td>1720W12</td>
<td>The Effect of Synthetic Auxins on the Rate of Flowering</td>
</tr>
<tr>
<td>Singh, Mannahat</td>
<td>1009W12</td>
<td>Wind Turbine System Used To Power The Battery Of An Electric Car</td>
</tr>
<tr>
<td>Singh, Mohini</td>
<td>115W12</td>
<td>The effect of Wolbachia on the Apis mellifera population</td>
</tr>
<tr>
<td>Smith, Heidi</td>
<td>401W12</td>
<td>Investigating the Roles of A2A and TrkB Receptor Proteins in Response to Cholesterol and Brain-derived Neurotrophic Factor (BDNF) in an Alzheimer’s Disease (AD) Model</td>
</tr>
<tr>
<td>Smith, Sarah</td>
<td>1611S10</td>
<td>The Relationship between Speed Walked on Energy Storage in a Circuit to Act as a Generating Device</td>
</tr>
<tr>
<td>Solhjou, Perri</td>
<td>1510S12</td>
<td>The Efficacy of Allium sativum, Hydroxypropanoic Acid, Isothiocyanate, and Acetylsalicyclic Acid, Individually and in Synergy, on the Retardation of Biofilm Formation in Bacteria</td>
</tr>
<tr>
<td>Subowo, Andrew</td>
<td>601D12</td>
<td>Development of Cross-Platform Software Architecture for Meteor Detection and Camera Calibration</td>
</tr>
<tr>
<td>Sullivan, Caitlyn</td>
<td>209V10</td>
<td>The Effect of Parents’ Taste Preference on Students’ Taste Preference</td>
</tr>
<tr>
<td>Sumathipala, Adriel</td>
<td>907B09</td>
<td>Biofuel Cells Made with Nanoparticles and Enzymes for Bioimplants and Biosensors</td>
</tr>
<tr>
<td>Swain, Thomas</td>
<td>107T12</td>
<td>A Comparison of Body Weight Between Koi Fish Treated with Melaleuca vs. Untreated</td>
</tr>
<tr>
<td>Tadepalli, Vaibhav</td>
<td>306L12</td>
<td>Can We Use Snails to Repair Ligaments?</td>
</tr>
<tr>
<td>Tagliaferri, Robert</td>
<td>1213P12</td>
<td>Testing for the Bioaccumulation of Strontium 90 in the Mollusks of Lake Anna</td>
</tr>
<tr>
<td>Talastas, Ashley</td>
<td>1715L11</td>
<td>Comparing the Relationship of Aloe Leaf Length in Sand vs. Soilless Media</td>
</tr>
<tr>
<td>Thekkel, Vineetha</td>
<td>307T12</td>
<td>The Effect of Herbal Alternatives on Cholesterol Reduction Compared to Prescription Medications</td>
</tr>
<tr>
<td>Thiel, Jacob</td>
<td>602H12</td>
<td>Navigation of a High School Building Through the Use of a Smartphone App</td>
</tr>
<tr>
<td>Thompson, Dannika</td>
<td>603C10</td>
<td>The Effect of Humidity on the Signal Strength of Wi-Fi</td>
</tr>
<tr>
<td>Tifft, Reilly</td>
<td>1214B10</td>
<td>The Effect of Salinity on Submerged Aquatic Vegetation Growth and Dominance in the Chesapeake Bay Tidal Zone</td>
</tr>
<tr>
<td>Tinius, Casey</td>
<td>404D10</td>
<td>The Effect of Bt Corn on an Organism’s Ability to Locate Food</td>
</tr>
<tr>
<td>Torres-Gonzalez, Jessica</td>
<td>217V10</td>
<td>A Sticky Situation</td>
</tr>
<tr>
<td>Triola, Marissa</td>
<td>908S10</td>
<td>The Effect of a Varied Projectile on Pine Wood and the Relationship of the Diameter of the Hole Corresponding with the Place of Impact</td>
</tr>
<tr>
<td>Tucker, James</td>
<td>909D12</td>
<td>Different Camera Housings on the Efficiency and Function of Nightime All-Sky Meteor-Detecting Cameras</td>
</tr>
<tr>
<td>Turnbull, Seth</td>
<td>1612L11</td>
<td>The Relationship Between the Total Watts in an EMF vs. the Amount of Watts Received by a Conduit of the EMF</td>
</tr>
<tr>
<td>Umstattd, Kendrick</td>
<td>1215C10</td>
<td>The Effect of Wind Speed and Topography on the Travel of Pollution Plumes</td>
</tr>
<tr>
<td>Vaillancourt, Lana</td>
<td>1107L11</td>
<td>The Impact of Nitrogen on Bioremediation of an Oil Spill</td>
</tr>
<tr>
<td>Name</td>
<td>Code</td>
<td>Title</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Vanderlyn, Lindsey</td>
<td>910W12</td>
<td>The Effect of Solvent on the Mechanical Strength of Electrospun Natural Biopolymer Meshes Containing Salts</td>
</tr>
<tr>
<td>Varghese, Ann</td>
<td>1513S10</td>
<td>The Effect of Oregon Grape Root and Amoxicillin, Alone and in Synergy, on Staphylococcus epidermidis</td>
</tr>
<tr>
<td>Vasquez-Bolanos, Laura</td>
<td>1514T10</td>
<td>The Effect of Different Fluoride Dentifrices on the Growth of Streptococcus mutans</td>
</tr>
<tr>
<td>Veligatla, Vasudha</td>
<td>1411J09</td>
<td>The Correlation Between Blood Type and Death Rate Due to Leukemia</td>
</tr>
<tr>
<td>Vemulapalli, Kireeti</td>
<td>1010J10</td>
<td>A Comparison Between Volts Produced by Solar Energy and Wind Energy</td>
</tr>
<tr>
<td>Verban, Jessica</td>
<td>1721D12</td>
<td>Nitrogen Fixation Enhancement in Phaseolus acutifolius (Tepary Beans) During Drought Conditions via Rhizobial Slurry Processing</td>
</tr>
<tr>
<td>Vermeland, Michael</td>
<td>1108H12</td>
<td>The Optimization of Surface Characteristics Through the Change of Relative Humidity in Order to Effectively Fog Harvest</td>
</tr>
<tr>
<td>Vitkus, Sara</td>
<td>503S12</td>
<td>A Golden Opportunity to go Green</td>
</tr>
<tr>
<td>Walser, Bryan</td>
<td>1722V10</td>
<td>The Effects of Caffeine on the Growth of Epipremnum aureum (Scindapsus aureum) Plants</td>
</tr>
<tr>
<td>Watson, Christopher</td>
<td>911P10</td>
<td>How Permanent are Permanent Markers?</td>
</tr>
<tr>
<td>Wenzel, Alyssa</td>
<td>1412D12</td>
<td>Analysis of Isoniazid as a DNA Methylation Inhibitor Inducing Autoimmunity</td>
</tr>
<tr>
<td>Whimpeny, Christopher</td>
<td>1216B09</td>
<td>The Effect of Housing Development Age on Soil Organic Carbon in Suburban Developments in Loudoun County, Virginia</td>
</tr>
<tr>
<td>White, James</td>
<td>912G12</td>
<td>Enhancing Kevlar Body Armor by Impregnating it with the Iron Sulfide Greigite</td>
</tr>
<tr>
<td>Williams, Stephanie</td>
<td>116D12</td>
<td>Pigment Deposition in Neural Crest During Embryonic Development of Danio rerio (Zebrafish)</td>
</tr>
<tr>
<td>Wong, Amanda</td>
<td>1723B09</td>
<td>The Effect of the Concentration of Citric Acid on Sunflower Seed Growth</td>
</tr>
<tr>
<td>Wright, Scott</td>
<td>911P10</td>
<td>How Permanent are Permanent Markers?</td>
</tr>
<tr>
<td>Yerramasu, Padmini</td>
<td>1413S10</td>
<td>The Effect of Sanguinarine in Chemoprotection and in Reducing the UV Exposure Mediated DNA Damage by Eliminating the Mutated Cells.</td>
</tr>
<tr>
<td>Zartman, Bradley</td>
<td>1414C10</td>
<td>Eating For Peak Performance</td>
</tr>
<tr>
<td>Zeman, Brock</td>
<td>1304C10</td>
<td>Using readability formulas to compare the average grade levels of popular publications throughout decades to determine fluctuations in readability ease over time</td>
</tr>
<tr>
<td>Zepeda, Melissa</td>
<td>1705V09</td>
<td>The Effect of Different Types of Light on Plant Growth</td>
</tr>
<tr>
<td>Zhang, Jeffrey</td>
<td>1305L12</td>
<td>Modeling the Effectiveness of Acetic Acid or Hydrated Lime as Treatment Methods for Invasive Didemnum vexillum in Puget Sound</td>
</tr>
<tr>
<td>Zometa, Nathaly</td>
<td>114V10</td>
<td>The Effect of Coca-Cola® on Daphnia pulex</td>
</tr>
</tbody>
</table>
## Animal Sciences (100)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>101G12</td>
<td>Carlton, Cassidy</td>
<td>Do Horses Have a Color Preference?</td>
</tr>
<tr>
<td>102C10</td>
<td>Cassidy, Kaitlin</td>
<td>The Effect of Hoof Distortion on Equine Lameness</td>
</tr>
<tr>
<td>103S09</td>
<td>Chowdhury, Abhilasha</td>
<td>The Effect Of Antioxidant Enriched Herbs On The Fertility Rate Of The Drosophila melanogaster Exposed To UV-C</td>
</tr>
<tr>
<td>104T11</td>
<td>Coppens, Emily</td>
<td>Does Exposure to Dog Parks Influence Dog Behavior?</td>
</tr>
<tr>
<td></td>
<td>Fricke, Danielle</td>
<td></td>
</tr>
<tr>
<td>105S09</td>
<td>Est, Lauren</td>
<td>The Relationship between Light and the Behavior of Drosophila</td>
</tr>
<tr>
<td>106F11</td>
<td>Francis, Audrey</td>
<td>Investigating the Effect of Biochanin A on Ivermectin Resistance in C. eleg</td>
</tr>
<tr>
<td>107T12</td>
<td>Hochstein, Alexis</td>
<td>A Comparison of Body Weight Between Koi Fish Treated with Melaleuca vs. Untreated</td>
</tr>
<tr>
<td></td>
<td>Swain, Thomas</td>
<td></td>
</tr>
<tr>
<td>108C10</td>
<td>Hochstein, Michael</td>
<td>The positive photaxis of greater wax moths for different light bulbs</td>
</tr>
<tr>
<td>109F11</td>
<td>Kirkpatrick, Andrea</td>
<td>Does the Barometric Pressure Affect the Amount of Food Consumed by Fish in Captivity?</td>
</tr>
<tr>
<td>110P11</td>
<td>Lunde, Mary</td>
<td>The Sense of Sight</td>
</tr>
<tr>
<td>111V11</td>
<td>Nelson, Mackenzie</td>
<td>Sugar Glider Tastes: What’s in Your Apple?</td>
</tr>
<tr>
<td>112F10</td>
<td>Richardson, Olivia</td>
<td>The effect of different scents on distance Camponotus pennsylvanicus travel in 10 seconds.</td>
</tr>
<tr>
<td>113C09</td>
<td>Rowell, Jessi</td>
<td>The Effect of Canis familiaris Paw Preference/Brain Lateralization on Performance</td>
</tr>
<tr>
<td>114V10</td>
<td>Schwartz, Daena</td>
<td>The Effect of Coca-Cola® on Daphnia pulex</td>
</tr>
<tr>
<td></td>
<td>Zometa, Nathaly</td>
<td></td>
</tr>
<tr>
<td>115W12</td>
<td>Singh, Mohini</td>
<td>The effect of Wolbachia on the Apis mellifera population</td>
</tr>
<tr>
<td>116D12</td>
<td>Williams, Stephanie</td>
<td>Pigment Deposition in Neural Crest During Embryonic Development of Danio rerio (Zebrafish)</td>
</tr>
</tbody>
</table>
Page intentionally left blank.
Do Horses Have a Color Preference?

Cassidy Carlton

This project demonstrated how horses see color. Documented research has shown that horses can see color. This experiment used the colors that research indicated that horses can see to determine if horses preferred a certain color. The hypothesis of this experiment is that if horses are given a choice of colored buckets to eat from, then they will choose the yellow bucket most often. The experiment used a yellow, blue, and green, eight quart utility bucket, Southern States Reliance 11% sweet feed, and thirty horses to determine a horse’s favorite color. There were six trials done for each horse to determine if they had a preferred color bucket to eat from. After each trial the buckets were switched around so that the horses did choose a color and not the place where they knew there was grain. It was concluded that horses do have a color preference. Each horse chose a color that they preferred. Most mares (68%) tended to repeatedly choose the same color bucket. More than half of the geldings (55%) did not seem to have a specific color preference. Horses chose the yellow bucket 46% of the time as opposed to the green or blue buckets which were only chosen 27% of the time. The data collected indicates that the hypothesis in this experiment was correct in that the horses chose the yellow bucket more often than they chose the blue or green buckets.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Hoof Distortion on Equine Lameness

Kaitlin Cassidy

Lameness is a common problem in horses and can greatly hinder their performance. Lameness is a common problem for horses of all ages and breeds. The purpose of this experiment was to determine the degree of hoof distortion's effect on horse lameness. Horses tested were thoroughbred-crosses that ranged from ages 10 to 20. The horses were put into categories based on hoof distortion severity. The groups were control, slight, moderate and severe. The horses were divided into the groups based on the factors of their frog to hoof ratio, the severity of underrun heels and toe angle. After the horses were measured, they were monitored for two months for occurrence of lameness. It revealed that there was no significant difference in the severity of hoof distortion and more frequent lameness. The statistical test used to determine this was Anova Single Factor. The results of this experiment did not support the alternate hypothesis and the null hypothesis of this experiment was accepted. However, an improvement to this experiment would be to increase the time the horse is monitored for lameness. Perhaps more results would show a more accurate depiction on hoof distortions effects.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect Of Antioxidant Enriched Herbs On The Fertility Rate Of The Drosophila melanogaster Exposed To UV-C

Abhilasha Chowdhury

Exposure to ionizing radiation, due to technological advancements and for medical diagnosis/treatment purposes has become a growing concern and can cause health hazards. This experiment evaluated the protective potential of the supplementation of phytochemicals (Panax ginseng, Coriandrum sativum, Mentha arvensis) by assessing their effects on the fertility and the population size of Drosophila melanogaster exposed to UVC.

Before the experiment, Drosophila melanogaster males and females were separated to avoid mating and five males and five females were put into each vial and were supplemented with each herb (IV) in growth medium for 4 days prior to the exposure. The experimental and the control (no supplement) were exposed to UVC for 90 minutes and were allowed to breed for 14 days. The final population (DV) was counted.

ANOVA and t-tests show statistically significant difference (p<0.5) in Drosophila melanogaster population in control group (irradiated but not supplemented with herb) with an average of 31.83 and the experiment groups supplemented with Panax ginseng, and Mentha arvensis had an average population of 64 and 67 showing the protective potential of Panax ginseng and Mentha arvensis in reverting UV radiation-induced DNA damage and detrimental effects on fertility. Mentha arvensis supplemented group had the highest average of population, thus supporting alternative hypothesis. However the group supplemented with, Coriandrum sativum (average 21.6) showed no difference (p>0.5) compared to control.

Human homologue of the Drosophila genes makes Drosophila a useful model organism in studying developmental and birth defects in humans. There is a greater chance of radiation damage to gonads when tissues are not matured. Further investigations may explore irradiating larvae embryo or first-instar stage. The efficacy of other phytochemicals in reverting radiation-induced DNA damage and detrimental effects on fertility need to be evaluated.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Does Exposure to Dog Parks Influence Dog Behavior?

Emily Coppens
Danielle Fricke

During the experiment on how dog parks influence the behavior of dogs, it was discovered that it has an impact on dogs in several ways. In order to get these results, an eight-question survey with an additional comments space below was provided. While at the park, a number of people agreed to take part in the survey. According to the surveys, the dogs' behavior seemed to become more compliant at the dog park. Exposure to a dog park is the independent variable. Dog behavior, influenced by exposure to a dog park, is the dependent variable. Also according to the numerical results, 29 out of 37 dog owners said 'Yes' to the survey question, "Does your dog's socialization skills seem to become better with interaction at the dog park?" From the data taken from results of all surveys, it was determined that the amount of negative behavior seemed to decrease at the dog park and their socialization increased. The control in the experiment was a comparison of how dogs behave at the dog park and how they behave at home. 26 out 37 participants said 'yes' to the survey question, "Do you see a decrease in negative behavior from your dog since visiting the dog park?" The results of this experiment confirmed the hypothesis that if dogs are exposed to dog parks then their behavior will be positively influenced. Not only did dogs seem to become more compliant, socialized and more welcoming towards other dogs and dog owners, but they also seemed to become more restful and healthy due to exposure to a dog park.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Relationship between Light and the Behavior of Drosophila

Lauren Est

This experiment shows the importance of light on animal behavior. Forty-five fruit flies were placed in a concealed environment with 24 hours of darkness (low intensity red light on), 24 hours of light, or 12 hours of light and 12 hours of darkness (12/12). The flies were videotaped for thirty minutes every 11.5 hours, and the minutes of activity were noted.

The results show that the average fly for 0 hours, 24 hours, and 12/12 hours were active for 16 minutes and 38 seconds, 25 minutes and 42 seconds, and 22 minutes and 12 seconds after receiving 12 hours of light and 14 minutes and 15 seconds after 12 hours of darkness, respectively. The T-tests showed significance between all groups (P less than 0.05). The amount of light given to the flies created a change in behavior because their light environment had been altered. Light has been shown to affect serotonin levels in the brain which affects behavior in animals. Lack of the hormone serotonin can cause panic, depression, anxiety, ADHD, insomnia, and multiple other emotional and behavioral disorders in humans. However, having a high concentration of serotonin in the body can cause restlessness and even seizures.

The number of flies that died over the course of the week for 0 hours, 24 hours, and 12/12 hours were 3 flies, 11 flies, and 7 flies, respectively. The numbers hatched for 0 hours, 24 hours, and 12/12 hours had produced 8 flies, 17 flies, and 14 flies.

Further research could test the effect of light on specific behaviors of fruit flies such as flight pattern and eating habits. These tests could also be performed over longer time frames.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Investigating the Effect of Biochanin A on Ivermectin Resistance in C. eleg

Audrey Francis

Increasing numbers of livestock are becoming resistant to roundworm de-worming regimens. The purpose of this research is to address the problem of parasitic worm resistance to a common anthelmintic, Ivermectin, using a flavonoid found in red clover and alfalfa called Biochanin A. Biochanin A functions to inhibit drug efflux from cells. It is hypothesized that administering Biochanin A in conjunction with Ivermectin would inhibit Ivermectin removal from cells, therefore causing greater reductions in worm population after treatment. The C. elegans strain DA1302, with genetic modifications to produce Ivermectin resistance, was used as a model for roundworms. To test the effect of administering Biochanin A in conjunction with Ivermectin, C. elegans are placed on a plate containing only Ivermectin, only Biochanin A or both Ivermectin and Biochanin A as well as a control plate with no drugs. Four days after the initial treatment, the plates are observed and analyzed based on the number of number of live versus dead C. elegans. It is expected that C. elegans treated simultaneously with Biochanin A and Ivermectin will show greater population reduction in response to treatment than those treated with either Ivermectin or Biochanin A individually. If successful, the results of this experiment could lead to a simple method of increasing the efficacy of Ivermectin by providing diets rich in alfalfa and red clover or by administering a purified form of Biochanin A at the time of treatment.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
A Comparison of Body Weight Between Koi Fish Treated with Melaleuca vs. Untreated

Alexis Hochstein
Thomas Swain

This project was designed to see whether or not melaleuca added to a Koi fish tank would have effect on fish body weight, color and overall health. For this experiment three trials were run. The first and second trials were comprised of two separate 25 gallon tanks with 5 koi in each. The third trial was comprised of two 75 gallon tanks with 13 koi in each. Each tank had weekly water checks and changes along with daily filter checks and weekly filter changes in order to obtain as clean water as possible. The fish in the 25 gallon tanks were fed 1.1 grams of (Koi fish food) daily. The fish in the 75 gallon tanks were fed 2.5 grams per day. The 25 gallon experimental tank had 0.4 grams of melaleuca added to it daily for 5 days. The control tank had none added. The 75 gallon experimental tank had 1.2 grams of melaleuca added daily for 5 days. The independent variable is the melaleuca. The dependent variable is the fish weight. Both tanks were monitored very carefully and temperature, water levels, light and food were the constants. Data was recorded through observation to determine if any changes were taking place with the fish. The fish that had the melaleuca added to their tank were taken out and weighed and looked over very carefully to see if they had gained any body weight or their color had changed or brightness/dullness had increased at planned increments. At the end of the experiment a conclusion was drawn that the MelaFix treated fish did gain weight. If more trials were run in this experiment, it may be concluded that the MelaFix was the reason for the weight gain.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The positive photaxis of greater wax moths for different light bulbs

Michael Hochstein

The problem investigated is which wavelength emitted from an incandescent, fluorescent, or yellow bug light bulb attracts the most moths. My hypothesis is fluorescent bulbs will attract the least moths due to their low wavelength. I will test this by using the three light bulbs in a Y-shaped enclosure. I will leave these on at night with no other lights present. I will count the amount of moths at thirty, forty-five, and sixty minutes. I repeat that three times, then total the number of moths at each type of different bulb for each time counted. I will find each bulb’s total. Then a single factor ANOVA test is run to determine if there is a significant difference. Some significant results I obtained were a total of 60 moths were counted near the fluorescent bulb. 131 moths were found near the incandescent bulb. 56 moths were found near the anti-bug light. The range of the fluorescent bulb was 7.83. The range for the incandescent was 15 1/3. 6.9 was the range for the yellow bug light. I conclude that fluorescent bulbs are not as attractive as incandescent bulbs, but are more attractive than yellow anti-bug lights. The coating on yellow bug lights shifts the spectrum far enough out of the moth’s visibility where it attracts the least amount of moths, and it is farther out of the moths’ visibility than the fluorescent bulb. Moths exhibit more positive phototaxis on lights they see better. Incandescent bulbs are the most visible to moths.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The purpose of this experiment is to find out if fish (Cyprinus carpio) in captivity can sense the change in barometric pressure (air pressure) and will change their eating habits, as they have been documented to do in the wild. The independent variable is the air pressure and the dependent variable is the time that it takes for the fish to consume the food. The constant variables are the amount of food given to the fish (9.7 grams of Tetra Koi Vibrance), the water quality, air temperature, and the water temperature. The result will be the relation between the time it takes the food that to be consumed and the barometric pressure (air pressure). The results of this experiments data proved the hypothesis to be correct. There are three significant result of this experiment; first it may tell aquarist if fish in captivity mimic the feeding behavior of fish in the wild. Second is it may be an economical benefit to the aquarist because it will save the amount of food given to the fish weekly. Lastly this information could reduce the risk of overfeeding the fish, which can lead to polluting the tank with an excessive amount of ammonia.
The Sense of Sight

Mary Lunde

The theory of sense dominance using fruit flies, Drosophila melanogaster, has been studied by many scientists worldwide. To study how fruit flies are attracted to light rather than food is discussed within the experiment, involving the degree to which sight is preferred. Fifteen fruit flies were added to each of the ten containers and were exposed to darkness. Half of the containers included a small sample of yeast solution, a substitute for rotting fruit, the natural food source for a fruit fly. Both sets of containers were exposed to a sudden beam of light by a flashlight. The containers with the food source caused the fruit flies to be susceptible to multiple senses of sight and smell causing dominance in one of them. The results of the experiment showed that a majority of fruit flies in each container were attracted to the light supporting the hypothesis stated, that the fruit flies would be drawn to the light rather than the food. Both the control group without the food and the experimental group with the food source had flies that were attracted to the beam of light. Further research could be performed with a larger quantity of containers.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Sugar Glider Tastes: What's in Your Apple?

Mackenzie Nelson

The purpose of the experiment was to determine whether Sugar Gliders (Petaurus breviceps), if given a variety of apples, would prefer to eat apples with a higher sugar content. The prediction was they would prefer apples with a higher sugar content over apples with a lower sugar content. A refractometer was used to test the four kinds of apples that were used in the experiment: Red Delicious, Gala, Honeycrisp, and Granny Smith. The Red Delicious would serve as the control apple, since this is what is normally given to them every night. It was discovered that the Granny Smith apple had the highest sugar content, followed by the Red Delicious, Gala, and finally Honeycrisp. Granny Smiths have a Brix percent level of 12.8; Red Delicious, 12.4 Brix percent; Galas, 10.8; and Honeycrisps, 10.4. After testing the apples for their sugar content, the apples were given to the Sugar Gliders starting on January 2, 2013. A Red Delicious apple was given first, followed by the Granny Smith, then the Gala, and finally the Honeycrisp. This cycle was performed for 16 days, so each apple would get an equal amount of four days. The Sugar Gliders ate all of the Red Delicious and Gala apples as expected, since they had higher sugar content levels. On two of the four days, they ate the entire Honeycrisp apple fourth, but on the other two days; they only ate a portion of the Honeycrisp apple. Surprisingly, given the stated prediction, the Sugar Gliders did not eat any of the Granny Smith portions that was given to them. This is possibly due to an unknown factor that causes the well-known tartness of Granny Smith apples. It could be acidity that caused the Sugar Gliders to not eat the apple.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of different scents on distance Camponotus pennsylavanicus travel in 10 seconds.

Olivia Richardson

With many insects invading homes and affecting people in general, the use of extremely harsh, chemical insect repellants is necessary to kill or avert the animals from houses or buildings. These methods are extremely costly and harsh on people with sensitivities or allergies. The Camponotus pennsylavanicus (ants) that were used in this project were capable of smelling stimuli from a distance (Drees, 2011). This project was meant to test if the different stimuli (salt, vinegar or cinnamon), would repel these ants and in turn, which would repel ants the farthest, in centimeters, in a span of 10 seconds. It was predicted that the cinnamon would repel the ants the farthest. During the experiment, the ants were placed about 7 centimeters from the stimuli and tested to see how far away the ants would travel. In the control group they traveled 9 centimeters, in both the salt and vinegar group they traveled 4 cm and with the vinegar they traveled 12 cm. The data was analyzed using t-test and the results were varied but stimuli showed a significant difference, and the experimental hypothesis was not supported. Ants responded to the vinegar stimuli the most. Further research to be done would include analyzing from how far away vinegar could repel ants and if there was another natural substance that would repel ants more than vinegar.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Canis familiaris Paw Preference/Brain Lateralization on Performance

Jessi Rowell

The purpose of this study is to find if Canis familiaris (common dog) paw preference affects how well the dog will perform. Thirty dogs were tested in this study. To find paw preference, a piece of tape was placed on the dog's snout and dominant paw was the paw used to remove tape. To find performance level, two tests were conducted. A treat was shown to the dog then dropped onto a towel held above dog's eye level. Level was determined by how well the dog followed the treat. In the second test, a treat was placed under a clear cup and level was evaluated by the dog's determination to get the treat from under the cup. Major findings found were that the level of training a dog had affected how well they performed on the towel drop test. However, paw preference/brain lateralization has no affect on how well a dog will perform. The hypothesis, If Canis familiaris is left paw dominant then the Canis familiaris will have a high performance level, was rejected. Further experimentation could include a larger test group with an equal number of males and females to see if gender affects paw preference. Also, only two or three breeds could be tested to find the affect of gender on paw preference.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Coca-Cola® on Daphnia pulex

Daena Schwartz
Nathaly Zometa

Daphnia pulex are small creatures that look more like fleas than crustaceans, and they might hold the key to understanding how certain substances, such as caffeine, will affect the human heart. Different concentrations of Coca-Cola®, which was the independent variable, were inserted into the environment of the Daphnia pulex and their heartbeats, the dependent variable, were recorded. Water, 0% concentration, was the control. The mean for 0mL was 92.41667, 5 mL was 58.58333, 10 mL was 38.58333, 15 mL was 18.5, and 20 mL 0. The alternative hypothesis: If Daphnia pulex are exposed to Original Coca-Cola® in different concentrations, then the highest concentration will increase their heartbeat the most per minute, was not supported. However, there was an obvious trend in the results and very significant differences in the groups for heart rate. This could show how humans’ hearts would be affected by caffeine, as they are similar to Daphnia pulex’s. Further research could explore the differing heartbeats when placed in varied concentrations and types of caffeine, thus showing how they might affect humans. More organisms could be used in the experiments done, for more accurate results and a better understanding of the conclusions reached.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of Wolbachia on the Apis mellifera population

Mohini Singh

Ninety percent of the crops worldwide are dependent on pollinators; one of the most abundant pollinators is the honeybee. The honeybee population is declining at a rate of twenty to thirty percent a year. This experiment was done to see if Wolbachia is a factor that plays a part in declining population. Wolbachia is a symbiotic bacteria that grows inside its host’s reproductive tissues. In some insects, Wolbachia has been identified as a factor in weakening offspring from generation to generation, killing the male embryos, and altering the sex ratio. DNA extracted from the bees was amplified using PCR and then separated by fragment size using gel electrophoresis. It was determined that some bees from each hive tested positive for Wolbachia. Current data shows that thirty two percent of the bees tested were positive. Additional bees are being tested. One of the hives in the study collapsed after bees were collected; this hive showed positive results for Wolbachia and fewer drone cells were observed. Based the data collected it can be concluded that Wolbachia can be a contributing factor for the decline in honeybee population and a possible factor in hive collapse. The collapsed hives were then mapped to observe if there was a correspondence between the location of the hive and the spread of the bacteria. The map was used to show the range of the spread of the infection. Further research will include more hives from different locations in Loudoun County, Virginia.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Pigment Deposition in Neural Crest During Embryonic Development of Danio rerio (Zebrafish)

Stephanie Williams

Zebrafish are often used as subjects in studying pigment development and deposition. Within six days of fertilization, embryonic development, chomophores, melanophore, and xanophore pigment cells form. It is for this reason that zebrafish can be used to study pigment mutations along the neural crest.

The purpose of this research was to determine whether exposure to light waves via laser ablation would impact pigment containing melanophore cell development and migration in zebrafish. Laser ablation was conducted by subjecting embryos to a 650 nm wavelength laser in two pulses of 40 seconds per pulse. Pigment development and deposition was toed for 6 days via images and was then analyzed using Image J.

Analysis via a t-test indicated that the null hypothesis, that there would be no difference in melanophore deposition if embryos were subjected to laser ablation, was refuted. Exposure to 650 nm light wavelength may have caused a mutation in the kit allele. The kit allele is heat sensitive and plays a key role in regeneration of melanocytes because the resultant kit receptor, protein tyrosine kinase, is used in differentiation of the melanin in the pigment cells. This allele does not function in temperatures between 23 °C and 25 °C. The temperature raise caused by the laser may have caused this heat-sensitive allele to mutate or turn off. Further research would entail determining whether the genotype of the fish was changed and the role temperature plays in the evolution of pigmentation in zebrafish.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>201W12</td>
<td>Abousaeedi, Ashkan</td>
<td>The effect of lunar phases on crime rate</td>
</tr>
<tr>
<td>202C10</td>
<td>Beard, Lauren</td>
<td>The Effect of Keyboard Layout on Typing Efficiency and Effectiveness</td>
</tr>
<tr>
<td>203T12</td>
<td>Corso, Andrew</td>
<td>Are a Majority of Teenagers Addicted to Social Networking Sites?</td>
</tr>
<tr>
<td>204V10</td>
<td>Dao, Uyen My Fuentes-Amaya, Gisela</td>
<td>Total Recall</td>
</tr>
<tr>
<td>205T12</td>
<td>Devilla, Kimberly</td>
<td>The Effects of a Romantic Relationship on Academic Performance and Self-Esteem</td>
</tr>
<tr>
<td>206G10</td>
<td>Downing, Kathryn</td>
<td>The Earworm Effect</td>
</tr>
<tr>
<td>207V10</td>
<td>Drennan, Nicholas Sheridan, Kyle</td>
<td>How Many Licks Does It Take to Get to the Center?</td>
</tr>
<tr>
<td>208V10</td>
<td>Faulkner, Charla Maranan, Jazzmin</td>
<td>The Effect of Music on Work Accuracy</td>
</tr>
<tr>
<td>209V10</td>
<td>Faulkner, Shannon Sullivan, Caitlyn</td>
<td>The Effect of Parents’ Taste Preference on Students’ Taste Preference</td>
</tr>
<tr>
<td>210D12</td>
<td>Froelich, Mitchell</td>
<td>Imagined Consumption Habituation Effects on Actual Food Consumption: A Dietary Strategy</td>
</tr>
<tr>
<td>211J10</td>
<td>Hutchison, Catherine</td>
<td>The Effect of Quantity of Facial Images Viewed on the Accuracy of Facial Recognition</td>
</tr>
<tr>
<td>212T12</td>
<td>Kidane, Sara</td>
<td>The Effects of Varying Work Efficiencies</td>
</tr>
<tr>
<td>213V10</td>
<td>Motazedi, Nina</td>
<td>The Effect of Color on Taste</td>
</tr>
<tr>
<td>214D12</td>
<td>Paz, Rose</td>
<td>The Role of Visual Illusion on the Prevention of Falls</td>
</tr>
<tr>
<td>215W12</td>
<td>Perara, Larissa</td>
<td>The Correlation Between Distance from Planned Parenthood Center, Education Attainment, Percent Employed, Population Density and Median Household Income with Pregnancy Rate in MD, VA, WV, DE, PA, and Washington, DC</td>
</tr>
<tr>
<td>216C10</td>
<td>Robillard, Rachel</td>
<td>Using Digital Photography, How Does Focal Length and F-stop Affect the Human Brain’s Ability to Properly Perform Pattern Recognition?</td>
</tr>
<tr>
<td>217V10</td>
<td>Torres-Gonzalez, Jessica</td>
<td>A Sticky Situation</td>
</tr>
</tbody>
</table>
The effect of lunar phases on crime rate

Ashkan Abousaeedi

The purpose of this project is to see if there is a correlation between Lunar Phases and the high amount of crimes committed. This would be beneficial to local/state governments in their effect of assigning more police stations in a selected area or building more parks around high populated areas. With the use of 4 years of Washington Dc crime data, the analysis of crimes committed on the lunar phases became simple. With the use of Arc GIS V10 all that was needed was to dissecting the data into separate files then merging them together in their type of lunar phase and year, then they were mapped in a ward outline of DC to see where the majority of crime is being committed. The results contradicted the initial hypothesis of “There will be more crimes committed on days of a Full moon because of the earth gravitational pull”. There was a clear higher amount of crime of New Moon days. This is probably due to the lack of moonlight. There were more crimes committed in ward 1 than any other wards; this is constant through all map analysis. This is the center of Dc and it has the highest population of all the wards. The T-Test analysis showed that there was little relationship between the crimes in their probability. If there was future research, the investigation doing weather correlation in all of DC would be an interesting one.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Keyboard Layout on Typing Efficiency and Effectiveness

Lauren Beard

Although popularization of the QWERTY Standard Keyboard superseded use of the Dvorak Keyboard over half a century ago, it is still argued that the ergonomically designed Dvorak Simplified Keyboard layout allows for faster typing and less errors due to its placement of the keys. This project investigated which keyboard layout resulted in the greatest efficiency and effectiveness. Thirty control group and thirty experimental test subjects were randomly selected to type a series of four 300-word passages, given two minutes for each. Subjects typed the passages on http://www.speedtypingonline.com/typing-test. The speed (WPM) and accuracy (%) were recorded for each passage. A T-Test was run and significant statistical differences were found between the mean accuracies of both the control and experimental group, but no significant statistical difference was found between the mean speeds of the two groups. It was hypothesized that student’s typing speeds and accuracies produced on a Dvorak keyboard will be greater than the speeds and accuracies produced on a QWERTY keyboard. The null hypothesis was rejected and the alternative hypothesis was partially supported. The speeds among the two groups were vastly different because of the learning curve to use the Dvorak keyboard. This even led to subjects using their fingers to type in a hunt-and-peck style. Further experimentation could include testing non-typists in both the control group and experimental group, or typists who are already skilled in use of both QWERTY and Dvorak keyboard layouts.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Are a Majority of Teenagers Addicted to Social Networking Sites?

Andrew Corso

Approximately 22% of teenagers log on to a social media 10 times a day. If a majority if teenagers are addicted to social media, this addiction is potentially causing a lack of scholastic focus and a lack of sleep. In this study, teenagers were evaluated for social media addiction. The independent variable was the number of teenagers tested and the dependent variable was the score of each individual the two distinct evaluations for social media addiction: Internet Addiction Test (I.A.T.) and Bergen Facebook Addiction Scale. For the I.A.T., a test subject had to score greater than 50 to show signs of addiction and 43 for the Bergen. Out of 65 total participants, 33 were male and 32 were female, including 24 fifteen-year olds, 19 sixteen-year olds, 13 seventeen-year olds, and 9 eighteen-year olds. The mean score for the I.A.T. and the Bergen were 37.4 and 38.0, respectively. For the Bergen test, the mean for males was 34.4 and the mean for females was 43.0. For the I.A.T., the mean for the males was 33.4 and the mean for the females was 41.5. The P value was 0.000083 for the Bergen using a two-tailed t-Test and 0.037 for the I.A.T. t-Test. The Bergen Test questions applied to the lives of teenagers. The mean score on the Bergen Test for females was 43, the accepted addiction level. They are considered addicted to social networking sites. The alternate hypothesis was not supported for males only. The size of the testing group could be a potential source of error. Research could additionally explore addiction levels of teenagers through testing of the urine to measure dopamine levels.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Total Recall

Uyen My Dao
Gisela Fuentes-Amaya

The purpose of this experiment was to test the memory of female and male teenagers. A series of random letters were shown to 25 males aged 14-16 and 25 females aged 14-16. They were then asked to recall the letters they have memorized. In each series the random letters increased by 3. The independent variable was the gender while the dependent variable was the numbers of random letters a male or a female teenager can recall. The statistics stated that there was no difference in female and male memory. The means for female subjects and male subjects were 4.12 and 4.08, respectively. Therefore the independent variable did not affect the dependent variable. In conclusion, the experiment supported the null hypothesis, but rejected the experimental hypothesis: “If male and female teenagers of ages 14-16 are asked to memorize up to 10 series of random letters, then the female teenager will have a longer term of memory than a male teenager.” Errors were discovered while experimenting such as the difference in testing area as well as distractions and pressure from everyday life. A question that came up during this experiment was, “Would it make a difference if the subjects were in a different age group?” Further research could explore a broader range of ages and limit the environmental factors that may affect the subjects.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effects of a Romantic Relationship on Academic Performance and Self-Esteem

Kimberly Devilla

This project aimed at studying the romantic relationship and its effects on academic performance, identity, and self-esteem. This study was conducted to discover whether or not there is an association between academic performance and involvement in adolescent romantic relationships and its effects on identity development and self-esteem. The variables looked at were dating status (single or committed), level of involvement in the relationships, grade point average, identity status, and self-esteem levels. Eighty-seven students, aging between fifteen-eighteen years old, were surveyed. Approximately fifty-two percent were female, forty-eight percent male, thirty-four percent committed, sixty-six percent single. Resulting the surveying, each section reported back with accepted null hypothesis (p>0.05). The original experimental hypothesis was that if one was in a romantic relationship, their academic performance would decrease, but their self-esteem would increase. The relationship assumed between grade point average, self-esteem and dating status was not supported by the data; it showed that there was no change in academic performance or self-esteem, whether one was single or committed. It should also be noted that there were many human errors in the process: incorrectly submitted surveys, time pressure, participants not understanding questions, and untrue responses. Further research could explore the other outside factors; such as, parent and peer influences, and the study of the adolescent growing period.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Earworm Effect

Kathryn Downing

The Earworm Effect is when a song, tune, or jingle gets stuck in your head. The purpose of this experiment is to see if the Earworm Effect is real, what genres of music are most memorable, and whether males or females are more affected by the Earworm Effect. The experiment used a group of 25 students aged 14 to 17 who listened to three different songs three times each. The students then recorded how often they thought of each song at subsequent intervals after the experiment. The results analyzed the recall ability of each sex for each genre.

Analysis showed students thought of Dream On the most (recall level of 2.10), and Ode to Joy the least (recall level of 1.38). Boys tended to be affected by the Earworm Effect more than girls were. After a t-test was conducted for the two sexes’ data, the p-value for Dream On was 0.059 and 0.0002 for Wanted and Ode to Joy. This shows a very significant difference between the sexes on the country and classical genre songs. My original hypothesis was that rock would be the genre that would get stuck in students’ heads the most, which was supported by the high recall level, and that girls would be more affected by the Earworm Effect, which was not supported. Further research could explore the origin of the Earworm Effect and whether it is affected by other factors such as age, musical ability, and the location or setting that the song is played.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
How Many Licks Does It Take to Get to the Center?

Nicholas Drennan
Kyle Sheridan

The goal of the experiment was to eliminate one or more of the possible data gaps of other, similar tests conducted around the country. The test was conducted by licking the same location on a tootsie pop repeatedly until the tootsie center was reached. Once the data was gathered, an ANOVA test was used to find statistical information which was used to determine whether color had an effect on the number of licks required. Two data gaps that were shown to be eliminated were that of location, the thinner middle of the tootsie pop, or the raised equatorial ridge that runs around the tootsie pop, and that of flavor. Both of these data gaps were addressed during testing since one was a matter of science, and the other a matter of procedure. The variables for the experiment were the flavor, with chocolate as the control, cherry and raspberry as the variants. Since the flavors of tootsie pops have different chemical compositions, it was postulated that the flavor had a tangible effect on the number of licks required to reach the tootsie center of the tootsie pop. The results acquired during the tests performed fell into the lower end of the spectrum from other tests, but above the lowest outlier. From this, one would be able to gather that location would have an effect on the number of licks, due to the amount of hard candy to lick through if one began on the equatorial ridge. From the data gathered during this experiment, one can also gather that flavor has no effect on the number of licks required to reach the tootsie center of a tootsie pop. These results support the proposed null-hypothesis, that flavor has no effect on the number of licks to the center of a tootsie pop.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Music on Work Accuracy

Charla Faulkner
Jazzmin Maranan

The purpose of this experiment is to inform people on which type of music helps with work accuracy. The independent variables for this experiment are pop and classical music. The dependent variable is the number of questions answered correctly. The control is no music. The test subjects for this experiment were high school students in the age range of 13-18 years old. To test the experiment, students worked on three different math worksheets while playing pop, classical, and no music. To find the results, an ANOVA test was performed. It was found that the independent variable had no effect on the dependent variable. The means for the control, classical, and pop music were 8.18, 8.3, and 7.58. The experimental hypothesis, “If a classical song is played, more students will answer more questions accurately, rather than listening to pop or no music,” was not supported. The ANOVA tests displayed that the p value of the experiment is greater than .05, which means that the null hypothesis was accepted. The test also showed that the independent variable had no effect on the dependent variable, thus, the control, no music, had a greater effect on the work accuracy of students. No major errors were present in this experiment. Further research could explore on whether different types of classical music have any effect on work accuracy or whether age has a different effect on work accuracy.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Parents’ Taste Preference on Students’ Taste Preference

Shannon Faulkner
Caitlyn Sullivan

This experiment is meant to discover if taste is genetic or not. A survey was created with twenty different foods on it. It asked the students if they liked it, and if the students’ parents liked it. The independent variable of this project is the parents’ taste preference. The dependent variable is the students’ taste preference. There is no control for this experiment. Every student asked to participate in the experiment was between the ages of thirteen to eighteen. There were twenty-five females and twenty-five males. After all the surveys were given out, data was collected and put into graphs. The data was analyzed. According to this experiment, taste is not genetic. The experimental hypothesis, if a certain person’s parents a certain food, then that person will like the food as well because taste preference is genetic, was not supported. There were 596 yeses observed for students and 904 yeses observed for parents. The Chi-Square test was used to further analyze this data. The Chi-Square test results showed that the null hypothesis was supported and the experimental hypothesis was not. According to this experiment, the independent variable did not effect the dependent variable. One major source of error was that some students had both parents to answer and others only had one, therefore changing the results of the experiment. One question that could be asked for this experiment; why wasn’t the experiment supported by the research and supported by the null hypothesis?

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Imagined Consumption Habituation Effects on Actual Food Consumption: A Dietary Strategy

Mitchell Froelich

Many strategies are used to reduce the amount an individual consumes daily. These strategies can be expensive, ineffective and unhealthy. Imagined consumption is the technique of imagining consuming one’s food before eating it to habituate one to it and reduce appetite.

The purpose of this research was to introduce a simple technique to help reduce food consumption. The technique of imagining consumption of food was tested against only picturing food by having subjects imagine 33 m&m’s then eat m&m’s and while others did not imagine consumption but pictured m&m’s in their minds then ate 33 m&m’s. Additionally, the technique was tested to see if amount imagined had any significant impact on amount consumed. Subjects imagined 3 m&m’s prior to consumption while others imagined 33 m&m’s prior to consumption; subsequent amounts eaten were noted.

Statistical analysis indicated that the difference in the amount the control group and experimental group consumed was not significant enough to conclude that the strategy of imagined consumption had an effect on amount eaten. Though not significantly different, on average the experimental group, which used imagined consumption, consumed approximately 7.25% less than those who did not.

The amount imagined prior to consumption did not have an effect on total amount consumed either. It may be that the majority of habituation occurs in the first few imagined “bites.” Continued research with a larger subject pool may help validate imagined consumption as a dietary strategy.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Quantity of Facial Images Viewed on the Accuracy of Facial Recognition

Catherine Hutchison

Even with advances in forensic science, eyewitness testimony in criminal trials remains crucial in many judicial proceedings today. When the accuracy of such testimony is called into question, it is important the factors affecting accuracy are known, and is also important to understand if the extent of the effect can be determined. Since the human brain perceives faces differently from other visual input, this experiment was designed to test how the amount of visual facial input affected the accuracy of recognition. 75 volunteers aged 14-17 were shown a short video and then asked to answer a question by selecting a photograph. The volunteers were divided into groups of 15 and each group was shown a different number of photographs. The control group was shown 6 photographs, the standard in many police procedures. Subsequent groups were shown 12, 18, 24, and 30 photographs, respectively. The null hypothesis, the number of facial images viewed does not have an effect on the accuracy of facial recognition, was rejected. An ANOVA F-test yielded a result of $F(2,222)= 146.07$ and a p value less than 0.001. The results are statistically significant and the alternate hypothesis, if the number of facial images viewed is increased, then the accuracy of recognition will decrease, was accepted. Further research would involve determining if the age of the test subjects affects the accuracy of the recognition, as well as expanding the number of test subjects used.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effects of Varying Work Efficiencies

Sara Kidane

The study conducted relates to social psychology and the concept of conformity. The purpose of the experiment was to test the work ethic of people who are surrounded by others that work at a fast pace. If subjects are surrounded by people working at a fast face, then the work pace of the subjects will increase as well. The dependent variable consisted of the number of envelopes created at the end of each five minute interval. The control group consisted of the first five minutes of the experiment where the group worked at a relatively comfortable pace. The experiment measured the amount of productivity and efficiency of each group, by recording the amount of envelopes created after a period of five minutes, when told to create an assembly line to create a more organized result. Afterwards, a "reinforcer" was added to create a faster pace to which other group members could conform. The most important results show that each group conformed to the manipulators speed. The results proved to be correct, making my hypothesis even more valid. The means for the control group, and the group affected by the fast pace were 31.93 and 47.47 envelopes per minute. The experimental hypothesis was supported due to the fact that each group made more envelopes as soon as the "reinforce" was added to speed up the pace, and make the group conform to the new pace. The null hypothesis was rejected, making the P-value <0.05. Further research could be discovered by conducting more experiments on productivity in the workforce or social psychology and conformity.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Color on Taste

Nina Motazed

This experiment demonstrates color’s impact on taste. Food coloring resembling common soda flavors will be added to clear-colored lemon-lime (Sprite) soda. 50 participants, of whom age, gender, and ethnicity do not matter, will taste the clear, red, orange, and purple drinks; waiting one minute between each drink. Afterwards, subjects will write the flavor on an index card. The independent variable is the color of soda. The dependent variable is whether the color of the soda affects the flavor. The control group consists of individuals who taste the clear cup of soda. The dominant flavor tasted was lemon-lime. Out of the three drinks with food coloring orange had the most individuals write the predicted flavor with 22% for orange, purple had 10% for grape and red had 8% for cherry. The chi-square test was performed; the two categories were Correct Flavor (lemon-lime) and Incorrect Flavor. The alternative hypothesis: if red, purple, and orange food coloring are added to clear-colored soda to resemble different flavors of soda, then the flavors tasted by the subjects will be grape (purple), orange (orange), and cherry (red), was rejected because p > .05. Statistically, color had no effect on taste. Identification of the predicted and other flavors display that color has some effect, differing between individuals. The bottles were replaced, therefore, re-dyed and may not have been identical in hue. Further research could explore why some individuals were fooled by the color.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
With increasing age, optical properties of the human eye are significantly altered. Reduced visual acuity, decreased depth perception, and far-sightedness are only a few of many age-related changes that occur in the elderly. Unfortunately, these factors contribute to increasing incidences of falls among elderly. Previous research on the effects of aging on the nervous system has led to linkage between visual perception and visuomotor action.

The purpose of this research was to determine whether a visual illusion could prevent falls in the elderly when ascending flights of stairs. Two sets of wooden steps of the same dimension were used in testing. One set was painted with vertical lines along its risers; the other’s risers were painted with horizontal lines. Subjects of varying age were asked to walk up both sets of steps, three times each, and leg elevation was measured as they cleared each step.

Statistical analysis was conducted and it was determined that all subjects cleared steps with vertical striping best. Young and middle-aged subjects cleared steps with greatest distance between their foot and steps. An explanation for these results is that in young subjects, overcompensation of step clearance may occur. In middle-aged subjects, visual acuity declines as aging increases, causing them to perceive the steps’ height to be greater than it is. Although the difference between step clearances in the horizontally and vertically painted sets was minimal in seniors, the data supports the idea that a visual illusion may prevent falls in the elderly.
The Correlation Between Distance from Planned Parenthood Center, Education Attainment, Percent Employed, Population Density and Median Household Income with Pregnancy Rate in MD, VA, WV, DE, PA, and Washington, DC

Larissa Perara

This project provides a visual representation of the correlation between demographic factors and pregnancy rate in women ages 15 to 19 to find trends to provide solutions to the rising issue of teen pregnancy. If certain factors such as the distance from Planned Parenthood locations in miles, the percent of population with a Bachelor’s degree or higher, percent employed, population density of people per mile, and median household income are looked at, then a relationship between these factors and the rate of pregnant women ages 15 to 19 per 1,000 women will be present.

Data from the American Community Survey (ACS) provided by United States Census Bureau and from the Environmental Systems Research Institute demographic and business data list was manipulated in Microsoft Excel and ArcMap to be expressed in charts and maps.

The higher the average population density and the higher percent of the population that obtained a Bachelor degree or higher, then the higher the average pregnancy rate are. To reduce teenage pregnancy the teenagers in highly populated areas should be focused on. These trends were found by looking at the line of regression and the r squared values on the graphs of the average of each variable and pregnancy rate per state.

The values given by ACS are estimates for each census block based on a sample gathered and this is a source of error. Further research would include looking at the correlation between graduation rate, parent’s marital status, and race differences with the rate of pregnancy.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Using Digital Photography, How Does Focal Length and F-stop Affect the Human Brain’s Ability to Properly Perform Pattern Recognition?

Rachel Robillard

The objective of this experiment is to explore improvements in visual recognition by understanding the brain’s ability to perform pattern recognition using different techniques of digital photography. The combination of standard camera settings (i.e. focal length and f-stop) was used to alter the amount and quality of information that gets exposed as a picture and challenges the brain to process information differently. A Chi Square test was used to determine if the observed results support the hypothesis. Throughout the experiment, what was concluded was that manually altered camera settings, f-stop and focal length, had a significant effect on pattern recognition in males, however they had little to no effect on the females’ ability to properly perform pattern recognition. The other conclusion that can be reached is that there is an “optimum” f-stop and focal length that yields the most accurate visual analysis of a digital photograph.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Students have a lot to study, so the usage of concentration methods is helpful. In this experiment, students’ test scores were compared to see if the utilization of mint gum was helpful in getting a higher score. The independent variable was the mint gum; the dependent variable was the test score the student got, and the control group was the students not chewing gum. The subjects were high school students, aged from 14 to 19, that were randomly picked. This experiment found that students chewing gum on average had a higher score of 82 than the students without the gum who had an 81.3 average. This alternative hypothesis was supported because the student with gum did get a better score. Further research could explore if using different methods have any effect on the scores.
Page intentionally left blank.
<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>301W12</td>
<td>Chea, Paula</td>
<td>The Effect of Natural Oils on Cyclooxygenase-2</td>
</tr>
<tr>
<td>302P09</td>
<td>Desantis, Allison</td>
<td>The Effect of Lactose and Glucose on Yeast Fermentation</td>
</tr>
<tr>
<td>303S12</td>
<td>Divi, Pranathi</td>
<td>The Efficacy of Various Reagents on Inhibition of Beta Amyloid Oligomerization in Transgenic Caenorhabditis elegans</td>
</tr>
<tr>
<td>304D12</td>
<td>Lee, Lisa</td>
<td>The Fibrinolysis of Blood Clots during Thrombosis via Kimchi Extract</td>
</tr>
<tr>
<td>305D12</td>
<td>Poehlman, Aristides</td>
<td>Optimal Temperature and Energy State for Tertiary Structure of Beta Dystroglycan Chain P</td>
</tr>
<tr>
<td>306L12</td>
<td>Tadepalli, Vaibhav</td>
<td>Can We Use Snails to Repair Ligaments?</td>
</tr>
<tr>
<td>307T12</td>
<td>Thekkel, Vineetha</td>
<td>The Effect of Herbal Alternatives on Cholesterol Reduction Compared to Prescription Medications</td>
</tr>
</tbody>
</table>
Page intentionally left blank.
The Effect of Natural Oils on Cyclooxygenase-2

Paula Chea

Cyclooxygenase-2 (COX-2) is an enzyme responsible for the main cause for the pain and inflammation in the joints of patients diagnosed with rheumatoid arthritis. This experiment will measure the absorbance and transmittance at different wavelength and amount of dissolving oxygen when natural oils (lavender oil, peppermint oil, sunflower oil, and peppermint oil) are mixed with COX-2. The results obtained were compared to find the best alternative remedy for rheumatoid arthritis.

To measure the chemical composition of the oils, a spectrophotometer was used to measures the wavelength absorbance and transmittance of the oils. A curvette with the oils was put inside the medium and a wavelength was selected to measure the absorbance and transmittance. To measure how natural oils can be inhibitors of COX-2 a dissolving oxygen probe was used to measure the dissolved oxygen in each solution in milligrams per liter.

The results of the experiment show that the average of absorbance for lavender oil is 8.08 \times 10^{-2}, peppermint oil is 6.65 \times 10^{-2}, sunflower oil is 4.77 \times 10^{-2}, and ginger oil is 6.81 \times 10^{-1}. The null hypothesis was rejected because the independent variable had affect on the dependent variable from looking at the data of the experiment. By analyzing the data is it concluded that certain enzymes have certain levels of concentration for an inhibitor to stop them. The term optimum is used to measure when the rate of the enzyme decreases. Although the concentration of ginger oil was high, it did not inhibit the enzyme as much as peppermint oil.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Lactose and Glucose on Yeast Fermentation

Allison Desantis

The purpose of this experiment was to compare the effects of two sugar solutions, lactose and glucose, on Baker’s yeast fermentation. This relates to the study of carbohydrates that yeast utilize for energy which is released through the fermentation reaction. This experiment tests which sugar, lactose or glucose will promote more fermentation. The height of the bubbles of carbon dioxide released in fermentation was measured for each sugar. The results show that the glucose had the highest average, 2.1 cm as compared to 0.3 cm for the lactose. The hypothesis, yeast in a glucose solution will undergo more fermentation, was supported by the data collected. Further research could explore how other carbohydrates compare to the rate at which the fermentation takes place with glucose.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Efficacy of Various Reagents on Inhibition of Beta Amyloid Oligomerization in Transgenic Caenorhabditis elegans

Pranathi Divi

In Alzheimer’s disease patients, dense, plaque-like structures form in the brain. These oligomers bind to surface receptors on neurons and change the structure of the synapse, thereby disrupting neural communication, leading to the onset of neurodegeneration and dementia. The peptide responsible for these deposits is the beta amyloid protein, which normally plays a nonpathogenic role in neural growth and repair.

In this experiment, a transgenic C. elegans model was used which had been genetically engineered to express the beta amyloid protein, and experiences paralysis due to Aß oligomerization. The worms were exposed to various reagents, including caffeine, ginkgo biloba, and ferulic acid in the E. coli food source.

The nematodes were exposed to the reagents, age synchronized, and the L3 stage was assayed using the nose touch technique to assess motor function and response.

Results are pending.

Further research analyzing the specific cell signaling pathway involved in brain tissue affected by Aß toxicity would further elucidate the specific mechanism of the peptide and its role in the Alzheimer’s disease.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Fibrinolysis of Blood Clots during Thrombosis via Kimchi Extract

Lisa Lee

Blood clots are a leading cause of health problems for many people. Diabetes, heart attacks, septicemia and Alzheimer’s are linked to blood clots. It is clear that targeting the formation and encouraging the dissolution of thrombi is medically compelling. Numerous side effects exist in using modern thrombolytic drugs. Of particular interest in this study is a naturally occurring fibrinolytic enzyme in a popular Asian food: kimchi.

Kimchi was incubated for 72 days then applied to horse blood clots alongside clots treated with phosphate buffer to mimic the human circulatory system. Control clots received no treatment. Fibrin plates were constructed, and kimchi juice, along with plasmin (the fibrinolytic inherent in an actual bloodstream), were placed on top of the plates. Due to thrombi dissolution, clot circumference increased an average of 0.15 millimeters for the control, 0.3 millimeters for the phosphate buffer, 0.5 millimeters for the .05 milliliters kimchi extract, and 1.5 millimeters for 1 milliliter. Through image analysis, average circumferences of fibrin disintegration around the areas treated were: kimchi extract of .05 mL - 2 mm circumference of disintegration, 1 milliliter of extract-3.5 mm, and 1.5 mL of extract- 4.2 mm. The plasmin showed only .75 mm disintegration.

Future implications of this type of alternative medication research may lead to the pursuit of healthier lifestyles and preempting health problems via eating the correct foods and taking the right supplements. In addition, naturally occurring medications harbor far fewer side effects, creating fewer complications.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Optimal Temperature and Energy State for Tertiary Structure of Beta Dystroglycan Chain P

Aristides Poehlman

Predictive protein folding is one method by which scientists attempt to identify specific protein functions in order to develop new treatments for diseases such as muscular dystrophy. Understanding complexity of protein folding is so challenging that scientists seek new computational ways such as online games and distributive computing to determine optimal functional structure. There is little time to image millions of proteins via crystallography so fast, efficient methods to predict protein folding processes may allow near-term breakthroughs in treatment discovery.

Protein folding is known to be affected by the temperature of the solvent in which it is placed. In a lab, determination of optimal temperature for folding and function takes inordinate amounts of time. Using simulations correctly may be more efficient. This research employed the use of Abalone Bio-Molecular modeling software to Monte-Carlo the target temperature of a protein chain called Beta-Dystroglycan Chain P which is part of the dystrophin complex associated with Muscular Dystrophy. The initial protein was constructed from the known amino acid sequence. One hundred trials of protein folding for 10 nanoseconds with 5 femtosecond step sizes were run to determine the lowest energy needed for optimal folding.

The Pearson correlation indicated a relationship between temperature and final energy. Temperatures ranging from 96 degrees Fahrenheit to 98 degrees Fahrenheit produced the lowest energy needed for optimal folding and hence proper protein function. Knowing how dystrophin folds properly can lead to the creation of new protein treatments which would combat Muscular Dystrophy.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Can We Use Snails to Repair Ligaments?

Vaibhav Tadepalli

The egg case of the genus Busycon is a proteinaceous material which exhibits highly durable, super-elastic qualities that, if synthesized, could be utilized in a wide variety of healthcare applications, such as a synthetic ligament replacement for torn ACLs. Assembly of a mature whelk egg case (MWEC) starts with the production of precursor proteins within the snail. These proteins exhibit none of the mechanical properties shown by the MWEC. Precursor proteins then undergo a maturation process, of which the most critical stage involves the covalent crosslinking of the proteins. Previous research has postulated that this crosslinking forms lysine-lysine crossbridges between the precursor proteins and that these crossbridges are responsible for the mechanical properties observed in the MWEC. The goal of this research is to induce this lysine bond between the precursor proteins in vitro through the use of an amine-reactive protein crosslinker BS3. Precursor proteins were obtained from pregnant female Busycon sinistrum, and crude extract of precursor proteins was prepared. Crude extract was then desalted, and treated with crosslinkers. Gel electrophoresis was run to determine if crosslinking was successful. From gels there is evidence to suggest crosslinking has been successful as shown by the larger molecular weight which has been observed. SEM images also provide qualitative data in support of crosslinking. Success in crosslinking is suggestive that a synthetic material could be produced, which could not only serve as synthetic ligaments but also as more durable parachute cords, and other materials which require elasticity and durability.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Herbal Alternatives on Cholesterol Reduction Compared to Prescription Medications

Vineetha Thekkel

One of the main causes of death in the United States of America is due to diseases that cause from high cholesterol in the body. Treatments for these diseases are often very expensive and the medications come with side effects. The purpose of this experiment is to find an alternative to these prescription medications that costs thousands of dollars every day. The experiment included the use of herbal alternatives for cholesterol medication and it tested the effectiveness of these herbs on cholesterol reduction. The independent variable included 4 different kinds of herbs, i.e. Garlic, Ginger, Cilantro, and Basil. The control group was the prescription medications Zocor and Lipitor. The experiment was done on pig fats and it helped measure the reduction of fat in each variable. The variables were diluted in distilled water and 10mL of the solution was poured on to approximately 25g of pig fat. The pig fat was weighted before and after the experiment and the data was collected 24 hours after the fat was exposed to the solutions. The results showed that Garlic was the most effective herbal alternative for Zocor and Lipitor as per the t-test (average of 22.68333g, p<0.5). T-test was performed to compare the results from Zocor and Lipitor to the other variables. The conclusion of the experiment is that Garlic can be used as an alternative for Zocor and Lipitor. However, the other herbs can be used as an alternative as well if the quantity was higher. Further research could include an experiment to test whether the herbal alternatives could be used for blood pressure treatments.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Page intentionally left blank.
## Cellular & Molecular Biology (400)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>401W12</td>
<td>Joyce, Jessica</td>
<td>Investigating the Roles of A2A and TrkB Receptor Proteins in Response to Cholesterol and Brain-derived Neurotrophic Factor (BDNF) in an Alzheimer's Disease (AD) Model</td>
</tr>
<tr>
<td></td>
<td>Smith, Heidi</td>
<td></td>
</tr>
<tr>
<td>402D12</td>
<td>McGeady, Caehla</td>
<td>The Effect of the Protein Lactoferrin on the Production of CD19+ antibodies in B lymphocytes</td>
</tr>
<tr>
<td>403F11</td>
<td>Morales, Grace</td>
<td>The difference in protection by supplemental antioxidants and natural fruit antioxidants when exposed to oxidative stress.</td>
</tr>
<tr>
<td>404D12</td>
<td>Tinius, Casey</td>
<td>The Effect of Bt Corn on an Organism’s Ability to Locate Food</td>
</tr>
</tbody>
</table>
Page intentionally left blank.
Investigating the Roles of A2A and TrkB Receptor Proteins in Response to Cholesterol and Brain-derived Neurotrophic Factor (BDNF) in an Alzheimer’s Disease (AD) Model

Jessica Joyce
Heidi Smith

Alzheimer’s disease is a neurodegenerative disease characterized by loss of neural tissue and the accumulation of extracellular beta-amyloid (Aβ) plaques, leading to the degeneration of neurons via apoptosis. Increased cholesterol in neuronal systems results in the formation of neurotoxic Aβ plaques. Brain-derived neurotrophic factor (BDNF) is a neurotrophin essential for neuronal growth that binds to the TrkB receptor protein. BDNF has been shown to promote cell survival despite the presence of Aβ plaques. In 2012, combined cholesterol and BDNF treatment resulted in decreased Aβ neurotoxicity beyond levels demonstrated in control and BDNF treatment groups. A2A receptor protein blocking has been linked to neutralization of Aβ neurotoxicity and has demonstrated some kind of interaction with TrkB proteins. In this research, A2A and TrkB are investigated for their role in upregulation of BDNF and Aβ neurotoxicity. Receptor antagonists were used to elucidate the roles of each protein in response to cholesterol and BDNF in an IMR-32 cell line. To date, cholesterol and BDNF treatments have resulted in increased glutamate concentration, indicative of TrkB activity, suggesting that cholesterol increases the translocation of the receptor protein, while increased ligand presence results in upregulation of TrkB activity. Research is ongoing to determine the roles of these receptors in mechanisms regulating Aβ neurotoxicity in a cholesterol- and BDNF-rich environment.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of the Protein Lactoferrin on the Production of CD19+ antibodies in B lymphocytes

Caehla McGeady

Many cancer-related deaths are the result of infection due to the inability of chemotherapy-weakened B lymphocytes to produce viable antibodies. Lactoferrin is a protein that is present in bodily fluids and has an unclear role in the immune system. The purpose of this research was to determine the effect of lactoferrin on antibody production in B lymphocytes. B lymphocytes were treated with lactoferrin and incubated for 72 hours. The resulting antibody concentration was measured using an ELISA kit which uses dyes to produce an optical density of absorbance which was read by a plate reader. After generating a standard curve, statistical analysis was conducted that indicated the concentration of antibodies produced was highest in cells exposed to 20 and 40 % concentrations of lactoferrin. Thus the null hypothesis, that lactoferrin would not affect antibody production in B lymphocytes, was rejected. Concentrations of lactoferrin higher than 50 percent failed to increase antibody production likely because lactoferrin as an iron-binding protein would monopolize all iron in the system and cause the cells to slow antibody production in order to preserve resources. This indicates that low concentrations of lactoferrin administered slowly may help to increase antibody production and restore immune response in a weakened immune system such as that of a cancer patient undergoing chemotherapy. Because iron is essential for cancer cells, the iron binding properties of lactoferrin could be optimized to both raise the immune response and inhibit cancer cell growth.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The difference in protection by supplemental antioxidants and natural fruit antioxidants when exposed to oxidative stress.

Grace Morales

This year’s research is done using flies with a mutation of the epidermal growth factor receptor (EGFR). Over expression of this receptor naturally exhibits oxidative stress on the organism leading some to develop cancer. Thus, different types of antioxidants were tested to try and reverse the effects of the mutation. Different forms of pomegranate, acai, and CoEnzyme Q10 are fed to D. melanogaster larvae and a Comet assay done on the cells. Expected results are that pure pomegranate will work best because it is the least processed and results last year showed that pomegranate juice was the most effective with protecting against nucleic acid damage caused by oxidative stress. Oxidative stress has been found to lead to many serious health issues including cancer and heart disease. Reducing the damage from the stress or even having a total reversal would greatly help prevent or reduce the risk of these health disorders.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The growth of crops which have been genetically engineered to be pest and drought resistant is becoming increasingly popular. These genetically modified organisms (GMOs) are found in practically every food source not specifically labeled “organic”. While a number of benefits are associated with cultivation of these organisms, many unknown and potentially harmful effects can occur in surrounding environments and in non-target organisms.

The purpose of this research was to determine if and how Bt corn affects an organism’s ability to locate food. Ten specimens of Physarum polycephalum were placed in individual mazes, five of which contained genetically modified cornmeal and five of which contained organic cornmeal. Pictures were taken at various times throughout the slime mold’s journey to the end of the maze to determine progress.

Analysis via a t-test show that, when compared to organic cornmeal, genetically modified cornmeal did not have an effect on the organism’s natural instincts of locating food. Thus the null hypothesis was accepted. It may be that GMOs do not affect non-target organisms in food foraging when found in these non-target organisms’ environment. If this is true, it could be due to the fact that when GMO pollen arrives in non-intended habitats, it does not necessarily prevent certain species from food acquisition but could play a role in affecting other physiological processes. Further testing must be conducted to determine how, specifically, the unintended spread of genetically modified crops play a role in environmental and health impacts.
## Chemistry (500)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>501J09</td>
<td>Harrigan, Colin</td>
<td>A Comparison of Levels of Lactose in Types of Milk</td>
</tr>
<tr>
<td>502V09</td>
<td>Hogarty, Joy</td>
<td>The Effect of Stain Guard on Carpet Stains</td>
</tr>
<tr>
<td>502V09</td>
<td>Mooney, Ryan</td>
<td>The Effect of Stain Guard on Carpet Stains</td>
</tr>
<tr>
<td>503S12</td>
<td>Jella, Jasmine</td>
<td>A Golden Opportunity to go Green</td>
</tr>
<tr>
<td>503S12</td>
<td>Vitkus, Sara</td>
<td>A Golden Opportunity to go Green</td>
</tr>
<tr>
<td>504W12</td>
<td>Lee, Kayeon</td>
<td>The Effects of UV and LED Lights and Humidity on Acrylic Paintings</td>
</tr>
<tr>
<td>505V10</td>
<td>Mooney, Justin</td>
<td>The Effect of Mold Growth on Bread</td>
</tr>
<tr>
<td>505V10</td>
<td>Ryan, Elizabeth</td>
<td>The Effect of Mold Growth on Bread</td>
</tr>
<tr>
<td>506J10</td>
<td>Morales, Daniela</td>
<td>The Effect of Calcium Hydroxide Removal on the Amount of Phosphorus in Pond Water</td>
</tr>
<tr>
<td>507B09</td>
<td>Muly, Olivia</td>
<td>The Effect of Sunlight on Ink Stability</td>
</tr>
<tr>
<td>508W12</td>
<td>Ouattara, Moustapha</td>
<td>The Effect of Extreme Heat on Metal Shell Casings and Fingerprint Visibility</td>
</tr>
<tr>
<td>509J10</td>
<td>Pandey, Sahan</td>
<td>The Effect of Sugar Coatings on Dissolving Time of Aspirin</td>
</tr>
<tr>
<td>510B09</td>
<td>Peruri, Alekhya</td>
<td>The Effect of the Type of Liquid on the Process of Electrolysis</td>
</tr>
<tr>
<td>511F10</td>
<td>Rillo, Miguel Lorenzo</td>
<td>The effect of different types of packaging on the amount of ascorbic acid in Pisum sativum (peas).</td>
</tr>
</tbody>
</table>
A Comparison of Levels of Lactose in Types of Milk

Colin Harrigan

The experiment measured the amount of lactose in different types of milk. The independent variable is the type of milk being tested. The dependent variable is the amount of lactose in the milk. Lactose was precipitated using acetic acid and calcium carbonate. The samples were then boiled and filtered to separate the lactose from the solution. Ethanol was added to the mixture to aid in lactose crystallization. The mean of the control (whole milk) was 0.6g of lactose, while other types of milk ranged between 0g and 2.5g. The experimental hypothesis was that the soy and almond milks would have 0g of lactose. Results of this study support the hypothesis. The null hypothesis was that all the milks will have equal amounts of lactose. Results of the one-way analysis of variance suggest that there is not a statistically significant difference between each of the milk types on the factor of lactose amount $F(3,11)=2.153$, $p=0.172$, $p-type1=.05$ and therefore accept the null hypothesis. Additional experimentation would include how aging affects the lactose amounts in milk.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Stain Guard on Carpet Stains

Joy Hogarty
Ryan Mooney

The purpose of this experiment was to study how well a commercial stain guard protects carpets from being permanently stained. The experiment was a comparison of two carpets, a section of carpet treated with stain guard and a section of bare carpet. They were each tested on how fast a stain (Kool-aid) would be visibly removed from the carpet. This was done by pouring water on each stain and then rubbing each stain with a household rag for the amount of seconds it took for the stains to come out of the carpets (timed with a stopwatch). The data were collected and analyzed using the t-test (overall p<0.10). This demonstrates that there was no statistical difference between the two carpets and therefore contradicted the original hypothesis (If a carpet is treated with stain guard, then it will prevent stains better than the carpet without). This hypothesis was not supported. However, the means show a slight difference in the time (19.593 seconds for the treated carpet, 26.004 seconds for the untreated carpet). Further research should be done on what specific chemical compounds work the best against carpet stains, whether certain carpets respond differently, and why.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
A Golden Opportunity to go Green

Jasmine Jella
Sara Vitkus

Gold nanoparticles are an emerging field for cancer research, particularly for use as drug carriers. Current gold nanoparticle synthesizing methods use expensive, toxic chemicals, so this experiment aims to replace this with an environmentally-friendly method using extracts created from organic waste materials. Previously, pine needle extract was demonstrated to have promise as a synthesizing agent. In order to determine and isolate the specific biomolecules responsible for the synthesis of the gold, vanillic acid and p-coumeric acid were tested, as they represent a high concentration in the phenolic composition of pine needles. Nanoparticle solutions were measured using a Microplate Spectrophotometer in order to generate a standard curve for analysis. Vanillic acid showed tremendous promise for its ability to reduce ions, but the nanoparticles agglomerated rapidly, which was demonstrated by a sudden drop in absorbance after a few days, a shift to a higher peak wavelength, and visible clustering in SEM images. With the addition of a synthetic capping agent, PVP, the vanillic acid was able to synthesize stable nanoparticles of a useful size. The reaction speed was substantially slower with p-coumeric acid; however, it yielded significantly smaller nanoparticles (shown in SEM images) than the vanillic acid which are more desirable for medical applications.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effects of UV and LED Lights and Humidity on Acrylic Paintings

Kayeon Lee

To maintain its quality as much and long as possible, an acrylic painting should be exhibited and stored under proper conditions regarding lighting and relative humidity. This project investigates the effects of the conditions of light and humidity on the quality of acrylics (independent variables). Sunlight, an LED video light, and a shower were used. The dependent variables are: the edges of the canvas curling, and changes in tone and texture compared to the initial conditions of fifteen red acrylic paintings for each condition.

Fifteen small canvas squares were exposed to each condition of UV sunlight and LED video light for a period of fifteen days, six hours daily. Another fifteen were exposed to a shower for fifteen days, thirty minutes daily. A LabQuest, light sensor, barometer, and relative humidity sensor measured the lights intensities and relative humidity. The results support the alternative hypothesis that if an acrylic painting is exposed to the light and humidity, then its quality will degrade. A T-test showed that the probability of each of the three degradations happening by chance was under 0.05, for instance, exposure to LED light had $2.16056 	imes 10^{-10}$ probability, indicating the damages done were a result of the independent variables.

Further research can be done for an expanded period of time to detect any possible further degradation.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Mold Growth on Bread

Justin Mooney
Elizabeth Ryan

The purpose of this experiment is to see how much mold will grow on bread, based on the temperature of the environment. By placing twenty pieces of bread in three controlled environments, mold will grow at different rates in each environment. The Independent Variable is the room temperature, and the Dependent Variable is the amount of mold grown in each group. This experiment was conducted by, placing twenty pieces of bread with thirty milliliters of water, wrapped in saurian wrap in each group, and record the growth of mold everyday for two weeks.

The results of this experiment were that the heat lamp group had the most, and fastest growing rate of mold compared to room temperature and freezer. The mean area of mold growth in the freezer group (0°C) was 0cm², room temperature (25°C) is 22.29cm², and heat lamp (35°C) was 28.79cm². The alternative hypothesis was, "If mold is grown on a piece of bread in 37°C, then there will be more mold on the bread than if it was grown at 25°C, or 0°C, this was supported because the null was rejected (P value was less than .05), the IV did support the DV. Further research would explore that, instead of testing quantitative, test qualitative, the type of mold grown on bread. Research what kind of molds there are and test what kind grows on bread.
Phosphorus is an essential element of commercial fertilizers. Without the use of fertilizers there would be famine and economic disruption. The purpose of this study was to determine if phosphorus can be extracted from waste water and if the amount will lessen the impacts of natural mining. The independent variable is the amount of calcium hydroxide used and the dependent variable is how much phosphorus is extracted. Distilled water was used as a control. In the experiment, calcium hydroxide was added in .2 g increments until no precipice forms.

The null hypothesis was rejected as the p-value was over .05. The average mass of the experiment category was 2.08 g while the control group was 1.42 g. Mean comparison using a t-test resulted in statistically significant results. The t-test resulted in a value of 7.9, degree of freedom was 14, and level of significance was 0.05.

The experimental hypothesis was supported because of the fact that the experimental group yielded more phosphorus then the control. The independent variable did affect the dependent variable because the more calcium hydroxide was added, the more phosphorus was recovered. Further research could test the pH balance of the water after the phosphorus has been extracted or the effectiveness of this technique could be compared to other techniques currently being used.
The Effect of Sunlight on Ink Stability

Olivia Muly

The purpose of the experiment was to determine if sunlight has any effect on ink stability; specifically, a common type of watercolor markers. Red, green, blue, and black colored tiles were exposed to simulated sunlight. Daily measurements were collected by a color flatbed scanner. A control panel was placed in storage with limited environmental exposure. The blue test panel tile changed the most from a mean RGB of 3.3/118.8/214.4 to a mean RGB of 68.7/107.6/154.4 after 16 days of exposure. All values are in 8-bit RGB units produced by the scanner. T-test statistics showed a statistical difference (P<0.01) between the control and exposed color tiles. Results showed a statistical difference, using the t-test, between the control and sunlight exposed test groups. Results varied from the marker color, with the blue tile changing the most. The null hypothesis, if ink is exposed to sunlight then there will be no affect on ink stability, was not supported. The independent variable, sunlight dose in days, did affect the dependent variable, RGB (red, blue, and green) 8-bit values produced by the scanner. Consistent application of ink to the test panels was the most challenging source of error. Further research should address additional ink types and answer why some colors are more sensitive than others to exposure.
The Effect of Extreme Heat on Metal Shell Casings and Fingerprint Visibility

Moustapha Ouattara

Crimes go cold and are never solved but a revolutionary can bring an end to all the worry because it is now possible to lift fingerprints off bullet casings and use them to solve crimes. As this experiment had already been attempted, the attempt here was to replicate it by using different metal casings as the Independent Variable to see if that choice would impact the Dependent Variable or quality of any visible print that was obtained which would be ranked on a scale ranging from 1-3 after the heating process through a Bunsen Burner at 600 degrees Fahrenheit for 45 seconds; cooled, then dusted with powder and given a rank with a 1 being no print present and a 3 being a clear defined print. A Control Group consisting of the same shells used was tested for prints but not heated. The results showed the Independent Variable did have an effect on the Dependent Variable proving that the metal type factored into the quality of the prints. To analyze the results a Chi Square test was done. Both the median and mean were 1. A source of error could be impurities on the casing affecting the development of prints. The null hypothesis was accepted because at a degree of freedom of 2 equals .05, the x² value of 0.419 was less than 5.991 and was not significant. As far as further research, research should be done to see if this technique can be applied on all surfaces besides metals.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Sugar Coatings on Dissolving Time of Aspirin

Sahan Pandey

Currently, people all over the world rely on some sort of medication. In some cases, relief is needed continuously and coating them in a certain way can ensure that. Oftentimes, medicine is coated. The purpose of this experiment was to test how time release of aspirin was changed by adding a coating to the aspirin. In order to do this, uncoated aspirins were coated with two different kinds of coatings. Then the aspirin was placed into 1M hydrochloric acid and the dissolution time was recorded. The control group was the uncoated aspirin tablets. For more consistent relief, it was found that dark corn syrup aspirin was the most effective, with a time of 512 seconds. The means of the other groups were 513 seconds (uncoated) and 1,518 seconds (light corn syrup). A t-test was performed that showed that there was a significant difference with light corn syrup with a value under .05 and small difference with dark corn syrup with a value larger than .05. It was determined that dark syrup coated aspirin was the most effective for consistency. The alternative hypothesis for this experiment was that by applying dark corn syrup coatings, the aspirins would be more consistent. The experimental hypothesis was accepted, while the null hypothesis was rejected. This shows that release time can actually be more continuous by adding coatings to the aspirin. Further research could be done to see if different brands of aspirin change the dissolution time.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of the Type of Liquid on the Process of Electrolysis

Alekhya Peruri

Many people wonder what the effect of increasing the direct current is on the rate of which hydrogen gas is produced during electrolysis. This is scientifically significant because it could help understand the process of electrolysis better in the fields of physics and chemistry. In this project, the IV is the amount of direct current (voltage) and the DV is the rate at which hydrogen gas is produced in minutes. The control group is the electrolysis of pure water. Here, the electrolysis of saltwater was done with different amounts of direct current. The highlight was that the amount of direct current does affect the rate of hydrogen gas production. The mean of the experimental group was 0 minutes, because electrolysis of water either takes a very long time or not at all, and the mean of the experimental groups of 1.5V was 12.9 minutes, 3V was 9.9 minutes, 6V was 5.7 minutes, and 9V was 3.2 minutes. From the T-test, by comparing the groups, the outcome shows that the increase of voltage affected the rate of hydrogen gas production. Therefore, the null hypothesis could be rejected. The alternative hypothesis: "If a higher direct current voltage is applied to the electrolysis process, then it will increase the rate at which hydrogen gas is produced", was definitely supported. The IV influenced the DV, and compared to the control group, the experimental group was greater. Further research could explore the change in liquid on the production of hydrogen gas or change in electrolyte.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of different types of packaging on the amount of ascorbic acid in Pisum sativum (peas).

Miguel Lorenzo Rillo

The purpose of the project was to test which type of packaging best preserves the vitamin C in Pisum sativum (peas) the best. The experiment tested fresh, frozen, and canned peas. It was hypothesized that frozen peas would preserve the vitamin C the best. This experiment is beneficial because vitamin C is an essential nutrient for all humans, and vitamin C is plentiful in peas so preserving it within the vegetable is important. In order to determine the amount of vitamin C in peas, an iodine titration is done. The more drops of iodine solution put into a sample before the color of the sample changes, the more vitamin C there is. After the experiment, the type of pea sample that contained the most vitamin C were the fresh peas. The sample with the least vitamin C were the canned peas. There was a significant difference between the amounts of vitamin C within each type of pea, but the experimental hypothesis was not supported. In conclusion, the type of pea that preserves the most vitamin C are fresh peas.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Page intentionally left blank.
## Computer Science (600)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>601D12</td>
<td>Subowo, Andrew</td>
<td>Development of Cross-Platform Software Architecture for Meteor Detection and Camera Calibration</td>
</tr>
<tr>
<td>602H12</td>
<td>Thiel, Jacob</td>
<td>Navigation of a High School Building Through the Use of a Smartphone App</td>
</tr>
<tr>
<td>603C10</td>
<td>Thompson, Dannika</td>
<td>The Effect of Humidity on the Signal Strength of Wi-Fi</td>
</tr>
</tbody>
</table>
Page intentionally left blank.
Development of Cross-Platform Software Architecture for Meteor Detection and Camera Calibration

Andrew Subowo

Software compatibility between multiple operating systems (OS) is limited, due to differing executable formats and Application Programming Interfaces, or APIs. One program developed by Oracle Corporation allows emulation of executables not native to the local operating system. These “Virtual Machines” allow users to run an entirely different operating system (referenced as a “Guest OS”) while simultaneously using the local operating system.

This research considered the applications of Virtual Machines to handle data transfer between two applications, both running on different operating systems (one on Windows, the other on a Linux distro), in a completely self-contained environment. The Windows application, Cameras for All-Sky Meteor Surveillance (CAMS), monitors the sky for meteors and generates pictures of the meteor streak. The Linux application, Astrometry, allows for astrometrical calibration allowing an astronomer to adjust his/her camera accordingly. The main focus was to create an application that allowed communication and data transfer between the two applications running on different operating systems via the Virtual Machine’s shared folders sharing capability. Scripts were created in the Guest OS to run in the background in order to assist with file management and handling. A Graphical User Interface (GUI) was coded in the programming language Java, on the local operating system (Windows) for user interaction, the result being that both applications were able to interact successfully. Continued research would eventually result in the development of an application that can contain all necessary resources to run both applications on one operating system instead of using a Virtual Machine.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Navigation of a High School Building Through the Use of a Smartphone App

Jacob Thiel

Using a Computer Aided Design (CAD) layout of Heritage High School and Geographic Information Systems (GIS), a Satellite Navigation System was developed in the form of a Smartphone Application. Unlike conventional navigation systems, this App will allow users to navigate both floors of the building (including stairs) to reach their next destination within the building.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Humidity on the Signal Strength of Wi-Fi

Dannika Thompson

This study investigates the relationship between natural phenomena and electromagnetic waves. The purpose of this experiment is to determine if the amount of water vapor in the air, humidity, has an effect on the signal strength of Wi-Fi, a service used by over 70% of the United States (according to U.S. Census Bureau). Humidity level, measured as relative humidity (RH) in percentage, serves as the independent variable, signal strength, measured in decibel-milliwatts (dBm), serves as the dependent variable, and signal strength at 40% RH (average household level) serves as the control group for comparison. Two laptops were distanced 5 meters from a router. 30 dBm measurements were recorded for each laptop at 6 different RH levels. The means for 40% (control), 50%, 60%, 70%, 80%, and 90% RH were -53.90, -58.97, -65.53, -70.23, -76.38, and -80.88, respectively. The Correlation test shows that a negative correlation exists between the two variables. As RH increases, Wi-Fi signal strength weakens. The Regression test shows that the experimental and control groups are statistically different. The alternative hypothesis is as stated: If the amount of water vapor in the air (humidity) is increased, then the strength of the Wi-Fi signal will decrease. Based on the results of the statistical analysis, the hypothesis is supported. Humidity has a negative effect on Wi-Fi signal strength. Further experimentation could include the study of the effects of other natural factors, such as temperature, on the transmission of electromagnetic waves.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Page intentionally left blank.
<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>701W12</td>
<td>Alcantara, Jed</td>
<td>The effect of the variance in the low crested, submerged structure of a tsunami barrier on the horizontal inundation distance of a tsunami</td>
</tr>
<tr>
<td>702D12</td>
<td>Bellamah, Miranda</td>
<td>An Analysis of Coastal Landscape Degradation Patterns via Landsat Imagery</td>
</tr>
<tr>
<td>703C10</td>
<td>Fischer, Megan</td>
<td>Determination of Sources Areas for Clasts within the Leesburg Member of the Balls Bluff Formation</td>
</tr>
<tr>
<td>704W11</td>
<td>Goriparthi, Abhishek</td>
<td>Earthquake Simulation &amp; Seismic Resistant Building Design</td>
</tr>
<tr>
<td>705F10</td>
<td>Janiga, Nicole</td>
<td>The effect of a manmade barrier on the strength of a rip current.</td>
</tr>
<tr>
<td>706C10</td>
<td>Knox, Chloe</td>
<td>The Effect of Ocean Temperature on Hurricane Intensity</td>
</tr>
<tr>
<td>707C10</td>
<td>Littell, Allison</td>
<td>The Accuracy of Fitzroy's Storm Glass Compared to Modern Day Weather Forecasting</td>
</tr>
<tr>
<td>708F10</td>
<td>Martin, Yolani</td>
<td>The effect of magnetic forces on how spherical masses move.</td>
</tr>
<tr>
<td>709J10</td>
<td>Nguyen, Trina</td>
<td>The Intensity and Frequency of Solar Flare Activity Over Time</td>
</tr>
</tbody>
</table>
Page intentionally left blank.
The effect of the variance in the low crested, submerged structure of a tsunami barrier on the horizontal inundation distance of a tsunami

Jed Alcantara

The purpose is to mitigate the horizontal inundation distance of tsunamis through a low crested, submerged tsunami barrier. The hypothesis is if a low crested, submerged tsunami barrier is built for height rather than width, then the horizontal inundation distance of a tsunami will be reduced more. The independent variables are the tall yet short or low and long barrier. The control is without a barrier. The dependant variable is the horizontal inundation distance measured in centimeters. A weight is dropped into a container of water which produces waves. The experiment measures the horizontal inundation distance that the waves pierce into the shore. The means are 19.16667 cm, 15.03333 cm, and 16.9 cm for the control, tall but short, and low and long barrier respectively. The statistical analysis is completed with ANOVA. The null hypothesis is rejected due to the small F Distribution. The results are due to the manipulation of the independent variable which reflected the results. Taller barriers are more efficient at reducing the horizontal inundation distance; however, as the experiment proceeded, the tall barrier was noticeably less attached to the base, while the low barrier remained firmly attached. Because the tall barrier receives the most resistance to the force of the tsunami due to its nature of reflecting rather than dissipating the forces of the tsunami, it requires a greater anchor with the contact area. Would the benefits of a more efficient barrier, a taller barrier, outweigh the price of maintenance over a long span of time?

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
An Analysis of Coastal Landscape Degradation Patterns via Landsat Imagery

Miranda Bellamah

Coastal landscape features such as marshes and inlands are crucial to the control of intensity and spatial patterns of hurricane storm impacts. However, hurricanes erode and redistribute sediments, potentially resulting in an increase or decrease of landmass and change in the physical construct of a region. Damage and economic impacts of disasters have increased at exponential rates in the past decades and are devastating socially, politically, economically, and environmentally.

This research analyzed the progression of coastal landscape change over time with regards to both natural and human-caused disasters. Landsat imaging of specific areas were generated from the United States Geological Survey (USGS) and analyzed using ImageJ. Image analysis was conducted by comparing the Chesapeake Bay, Outer Banks, and Florida Coast. Hurricane tracks through specific geographic areas were analyzed to determine time of critical impact on coastal areas. The area of impact in the Chesapeake Bay increased from 1991 to 2005, the area of impact in the Outer Banks fluctuated but ultimately increased between 1986 and 2005, and the impact on area of the Florida Coast decreased from 1984 to 2006.

Continued research on change in coastal area in regards to hurricane activity is imperative. If the topographic change and conditions causing it can be analyzed using satellite imagery, recommendations could be made as to how to rehabilitate and manage these fragile areas. This is important because degradation of land should be understood so that it can be prevented and improved if necessary.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Determination of Sources Areas for Clasts within the Leesburg Member of the Balls Bluff Formation

Megan Fischer

The Triassic-aged Leesburg Member of the Balls Bluff Formation formed as a series of alluvial fans within the Culpeper Basin of Northern Virginia. The Leesburg Member extends from south of Leesburg, Virginia, north to the Potomac River. The Bull Run Mountain Fault, a normal fault, served as the boundary fault on the west side of Culpeper Basin half-graben. The rift basin formed during the breakup of the supercontinent Pangaea. Eroding highlands to the west of the boundary fault are hypothesized as the source of detrital clasts within the Leesburg Member. The Leesburg Member is a carbonate conglomerate with a matrix consisting of maroon-brown, limey siltstone; clasts are subangular to subrounded fragments (< 1 centimeter to > 0.2 meters in diameter) of dark gray limestone (60 to 80 percent) and dolomite (15 to 25 percent). Based on clast types, a source area comprised of limestone and dolomite is inferred. No such nearby source bedrock is currently present to the west of the Leesburg Member outcrop area. However, the Cambrian-aged Frederick Formation and the Cambrian- to Ordovician-aged Grove Formation, both consisting of dark gray limestone and dolomite, are located directly north of the Leesburg Member outcrop area (beyond the Potomac River). As the Frederick and Grove Formations are interpreted as the most likely sources for the clasts within the Leesburg Member, it is inferred that southwestern extensions of those formations were once present to the west of the Leesburg Member, but that these extensions of the formations were subsequently eroded.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
According to scientists, earth's crust is broken into 30 plates. These plates floating on a layer of soft molten rock move an inch or two each year, but that is enough to generate enormous shock waves when they collide with each other creating an earthquake. The purpose of this project is to build an electronic shake table that can simulate the motion of an earthquake so that structural design ideas can be tested for their seismic resistance.

A geared motor attached to the base forces the top plate, with design specimens attached to it, to slide back and forth. The Independent variable was the design type of structure. The Dependent variable was how a structure withstood shaking forces. The Control group was the structure with no reinforced support. The experimental hypothesis was that the building with structural bracing would better withstand forces of an earthquake. Statistical analysis of data showed that this hypothesis should be accepted because the control group swayed heavily while the buildings with cross-bracing and corner bracing swayed much less. Another observation that came to the fore was that ductility and lower mass of materials play a positive role. These findings should be useful to engineers to consider while building earthquake safe buildings.

Further research would experiment with base isolation of structure from the foundation and use of shear walls to act as dampeners.
The effect of a manmade barrier on the strength of a rip current.

Nicole Janiga

This experiment used a model to test the effect of a barrier on the time it takes water from a rip current to flow through a break in the sandbar and fill up the model 7 centimeters. The purpose of this experiment is to find out if the threat of rip currents can be reduced in order to decrease the death toll caused by rip currents. The water used for this experiment was kept at a constant speed of 11.5 liters per second. The time it takes the container to fill up was tested before the break in the sandbar was formed to simulate the speed of the water before the formation of the rip current. The control group with no barrier was tested along with a solid barrier and a semi permeable barrier. Each group tested showed a significant difference in the time it took for the container to fill up. The data retrieved showed that although the barriers were not able to slow down the current to its initial speed, the water was flowing significantly slower than it was with no barrier after a barrier was put into place. The solid barrier slowed down the current more than the semi permeable barrier. This supported the experimental hypothesis that the solid barrier would be more effective than the semi permeable barrier at slowing down the rip current. However, a semi permeable barrier could be beneficial because it would still allow water to flow freely through it.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Ocean Temperature on Hurricane Intensity

Chloe Knox

Temperatures in the Atlantic Ocean (in degrees Celsius) and severe hurricane totals (3-5 according to the Staffir-Simpson hurricane scale) from the past thirty years were compared in this experiment by averaging both for an annual average. Temperature anomalies, or the departure for a standard average temperature, and total number of hurricanes (1-5 SSHS) were also compared for further justification. In total, four categories were compared: absolute temperature and severe hurricanes, absolute temperature and total hurricanes, temperature anomalies and severe hurricanes, and temperature anomalies and total hurricanes. Both p-values and Pearson R correlation values were calculated for each pair. P < 0.05, indicating a statistical difference between every group and rejecting the null hypothesis that ocean temperature will have no effect on a hurricane’s intensity. To visually represent this result, the correlation values (ranging from 0.604-0.654) were graphed, and showed that as the temperature or anomaly increased on the x-axis, the severe or total hurricane count increased on the y-axis. All these findings supported the alternative hypothesis that when the ocean is warmer, there is higher hurricane intensity. The supported hypothesis also means that the warming of our oceans is potentially very dangerous. Further studies can be done to discover a way to either protect land from dangerous storms or an efficient way to prevent a further increase in ocean temperature. Also, hurricane patterns can be looked at in oceans regions other than the northern Atlantic.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The accuracy of Fitzroy's storm glass compared to modern day weather forecasting

Allison Littell

The purpose of this experiment was to find out if weather forecasting today was more accurate than it was in the 1800’s. The storm glass was observed each day in order to test the accuracy; the temperature and humidity were recorded each day for a month from the National Weather Service (www.weather.gov). The storm glass observations were compared to the actual weather. The hypothesis was if the storm glass that Fitzroy used on the Darwin Expedition was compared to modern day weather forecasting, then modern day weather forecasting would be more accurate. To make the storm glass distilled water was used, potassium nitrate, ammonium chloride, and camphor. After all of these chemicals were combined, they were put into a graduated cylinder in the garage. Every day for a month the storm glass was observed and the observation was recorded using a storm glass key. Also, the actual temperature and humidity were recorded from the National Weather Service (www.weather.gov). The hypothesis was supported; storm glass was much less accurate than modern weather forecasting. When storm glass was used in the 1800’s it had about a fifty percent chance of being accurate, but these early forecasting instruments generated continued research in meteorology. Better understanding of our atmosphere and advanced technology have been able to improve weather prediction, which explains why modern weather forecasting is much more accurate.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of magnetic forces on how spherical masses move.

Yolani Martin

The purpose of this experiment was to test the magnetic forces and discover how they can increase in power over time. Magnetic forces are also related to the invisible forces in the solar system that can push and pull things apart (World of Scientific Discovery, 2010). This experiment tested how changes in the number of magnets used to attract a metal sphere would affect the time it took to move the sphere 10 centimeters. The procedures instructed for the metal sphere to be placed ten centimeters away from the magnet, which was covered by a cup, and the sphere then moved towards the magnet, where its time was recorded. The results showed a significant difference with 3, 4, and 5 magnets. This shows that when magnetic forces are increased they then draw materials with distinct properties quicker than a weak magnetic force. This experiment gives others a chance to see how strong magnets are as well as what it could possibly do beyond Earth.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Intensity and Frequency of Solar Flare Activity Over Time

Trina Nguyen

Solar activity has occurred countless times throughout Earth's history. The purpose of this research was to find how the intensity and frequency of solar flares has changed over time. This research was done through the use of databases, such as the National Aeronautics and Space Administration (NASA) website, to find classes of solar flares that occurred during the years 2010, 2011, and 2012. Ranks of 1, 2, and 3 were assigned to solar flare classes C, M, and X, respectively. Data was recorded with mode of 9; mean of 8; median of 8. The standard deviation of 0.5 was found in 2010; 0.5 in 2011; and 0.7 in 2012. The data supports the experimental hypothesis that in the past three years, there is an increase in the rank and frequency of solar flares. A one-way ANOVA showed significance, with F(1, 23)= 6.59, p=.006, =.05; therefore rejecting the null hypothesis. Further research includes looking at weather patterns of Earth to determine if there is a correlation with an increase of solar activity.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Page intentionally left blank.
# Engineering: Electrical & Mechanical (800)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>801T12</td>
<td>Aird, Justin</td>
<td>Using a Capacitor as a Lightning Rod to Deflect Lightning to a Place of Absorption as an Alternative Energy Source</td>
</tr>
<tr>
<td>802F10</td>
<td>Bundy, Austen</td>
<td>The effect of solar energy on the amount of radio waves transmitted over time.</td>
</tr>
<tr>
<td>803W12</td>
<td>Davis, Kaelin</td>
<td>Prosthetic Hand</td>
</tr>
<tr>
<td>804T12</td>
<td>Hilado, Sarah</td>
<td>What is the Best Solution to Prevent the Collapse of Buildings Caused by Mechanical Resonance?</td>
</tr>
<tr>
<td>805C10</td>
<td>Littell, Emily</td>
<td>The Effect of Blade Length and Width on Energy Output of a Wind Turbine</td>
</tr>
<tr>
<td>806C10</td>
<td>Marten, Carter</td>
<td>How Much Do Different Types of Lines Stretch Relative to Each Other?</td>
</tr>
<tr>
<td>807F10</td>
<td>Olson, Rebecca</td>
<td>The effect of steel, pine timber, and brick on electromagnetic wave attenuation.</td>
</tr>
<tr>
<td>808T12</td>
<td>Palmer, Dagney</td>
<td>The Effect of Geometric Structure on Ion Propelled Aircraft Flight Height and Weight Capacity</td>
</tr>
<tr>
<td></td>
<td>Samios, Elizabeth</td>
<td></td>
</tr>
</tbody>
</table>
Using a Capacitor as a Lightning Rod to Deflect Lightning to a Place of Absorption as an Alternative Energy Source

Justin Aird

Lightning is a largely untapped source of energy. One lightning streak can produce enough energy to light 1000 100watt light bulbs for a month. With the world in need of new energy sources, scientists attempt harness the power of lightning. Problem is that lightning is unpredictable, and difficult to work with. However, if it were possible to deflect the strike, it could be possible to store it. To determine if lightning can become an energy source, the arcs of electrical discharges produced by a Vander Graff Generator were altered when striking a capacitor acting as a lightning rod to direct energy so it could be absorbed. This experiment would be conducted by setting up an apparatus using the Vander Graff as a theoretical lightning strike having it strike the capacitor. The voltages that flow across the capacitor landing on sheets of metal nearby recording the voltage across those metal sheets. This would be used to create a voltage breakdown map of how far the voltage travels once being struck by the capacitor. This would determine how far the voltage travels after hitting capacitor and would determine a voltage field. The results from running this test showed that voltages were running across the capacitor when being used as a lightning rod and travel over certain areas and this proved the principle of using a capacitor to deflect lightning.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of solar energy on the amount of radio waves transmitted over time.

Austen Bundy

Abstract Form
This experiment tested if a solar panel can power an electronic just as well as a battery or power outlet. A 5 Watt and 12 Volt solar panel was taken and plugged into a walkie-talkie that was default set to 25 MHz. The control group was another walkie-talkie that was powered by batteries and also set to 25 MHz. After 5 minute periods for 75 minutes, the transmitters were checked to see if they were still being powered and transmitting at the same frequency. The average transmission for both was 25 MHz. There was not a significant difference in the data and the null hypothesis was accepted over the alternate hypothesis. The experimental hypothesis was if a radio transmitter is powered by solar energy from a solar panel, then fewer MHz will be transmitted. This means that both radios cannot communicate with each other clearly on the same frequency.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Prosthetic Hand

Kaelin Davis

Prosthetic have been around for eons as a means to hide deformities resulting from necessary amputation, however it is within this day in age prosthetic have become more and more seen as the limbs themselves rather not just another replacement, functioning and operating as an extension of your formal self. It is through simple engineering and understanding of the limbs physiology and anatomy that one can construct such devices out of everyday materials. To build devices capable of performing even the simplest of actions of gripping an object. That is what aimed to do, to fabricate a device that would simply do that, so I built a prosthetic hand out of Legos, powered by just 3 motors. All of this made possible with the help of the user friendly NXT programming software and some touch pad sensors. Once the device was built, the prosthetic hand had to be tested by testing whether or not the hand was capable of gripping common household items that were found around the house. Ranging from a banana and a tennis ball to a spoon and #2 pencil, a range of items tested for both condition of grip, power and precision. From what was found the device performed far and beyond as expected successfully gripping all items tested on except for the #2 pencil and a pawn chess piece. For further development to this project is the introduction of myoelectric sensors in order to have all of the movement performed not my touching the sensors pads but by the electromagnetic pulse that are sent throughout our body by our nerves system.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
What is the Best Solution to Prevent the Collapse of Buildings Caused by Mechanical Resonance?

Sarah Hilado

Preventing a resonance disaster in any building project is a major concern for all construction companies. The purpose of this experiment is to determine what dampening mechanisms are most effective in stabilizing a building during an earthquake. A model building and shake table were used to simulate the environment. A ground isolator (springs) and pendulum counterweight (suspended racquetball) were the independent variables and a building with no mechanisms installed served as the control group. The dependent variable was the ability of the mechanisms to prevent collapse when at the building’s resonant frequency. The resonant frequency was determined by taking the average RPM at which the control building collapsed. The independent variables were then tested at the average resonant frequency to find out if they could sustain the vibrations. The data showed that the pendulum counterweight was able to sustain the vibrations through 7 of the 15 trials at the resonant frequency of 89.8 RPM while the ground isolator was only able to sustain through 3 of the 15 trials. A Chi-Square statistical test was performed to prove that the data was statistically significant. The alternative hypothesis that the ground isolation system would be more effective was not supported. Further research could explore the effectiveness of more dampening mechanisms.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Blade Length and Width on Energy Output of a Wind Turbine

Emily Littell

Different blade sizes were used to test the energy output of a wind turbine. The project compared the blade area, found by multiplying the blade length by the blade width, with the amount of energy produced. Six sets of different blades were constructed using cardboard and the blades were then attached to a mini wind turbine, which did not have a motor. Each set of blades was tested to see how many bolts the wind turbine could lift when a fan was turned on. The amount of bolts lifted showed the amount of energy produced per blade size. The Correlation and Regression statistical test was used. No statistical difference was found between the blade sizes. The hypothesis for this experiment was rejected, and the null hypothesis was supported. The results showed that blade size did not affect the amount of energy created by a wind turbine. The experiment could be improved by using larger, more varied blade sizes and by focusing more on the angle of the blade. A fifteen degree angle was used for the blades. Further experimentation could include testing a bigger wind turbine model to see if the correlation between size and energy output remained the same. Other experiments could be to test the energy production of a wind turbine compared to the energy production of other fossil fuels, or test the effect of blade angle on energy production.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
How Much Do Different Types of Lines Stretch Relative to Each Other?

Carter Marten

The purpose is to find out how much different types of fishing line stretch relative to each other. To do this, the lines are being compared to each other by weight, type, and brand. The dependent variable is how much the line stretches in centimeters. Findings suggested monofilament line stretches constantly (a few centimeters each test), fluorocarbon line stretches vastly then barely at all (it would stretch 8 centimeters at first then only half a centimeter), and fused line stretches as it is being taken to the pound needed. The hypothesis, all the lines will stretch differently relative to each other, was supported by P-Value 0<0.0000035 which came from an ANOVA test. Further research could explore the line being put into more realistic situations, creating a test that puts the line under various amounts of stress and for random amounts of time, and the lines being tested in different climates to see if it affects the lines elasticity.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of steel, pine timber, and brick on electromagnetic wave attenuation.

Rebecca Olson

This experiment tests the effect of steel, pine plywood, and brick on electromagnetic wave attenuation. The control is signal attenuation with no material surrounding the wireless router. This experiment is significant because it will help people know what material is best to use in construction to block Wi-Fi signals. This information could be used by organizations such as the government to create buildings that keep Wi-Fi signals secured. Steel was the material expected to be most effective at blocking Wi-Fi signals. The experiment was done by surrounding a wireless router with each material and measuring the amount of attenuation. The results showed that the mean for attenuation was -68, -46, and -55 decibels for steel, pine plywood and brick, respectively. The mean for the control was -46 decibels. Using a T-test these means are considered significantly different, except for when comparing pine plywood to the control. The experimental hypothesis is clearly supported by the results. This experiment can be continued by changing the distance between the Wi-Fi router and the laptop, the materials that were tested, for example drywall and concrete, or by changing the frequency of the Wi-Fi signals.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Geometric Structure on Ion Propelled Aircraft Flight Height and Weight Capacity

Dagney Palmer
Elizabeth Samios

The purpose of this experiment was to find the best geometric shape for the frame of an ionocraft so that it flies the highest and can carry the most weight. This is significant because ion technology could be used in the future as an efficient energy source. The independent variable in the experiment was the geometric frame of the ionocraft and the amount of weight added to the ion craft. The dependent variable was the amount of time the aircraft flew in seconds. The control group was the small triangle because it is the most common configuration of ion propelled aircraft and weighs the least. The experiment was implemented by activating each ion craft and measuring how long and how high each flew. The lifters with the smallest weights moved the longest: the mean time that the small triangle moved was 6.39466667 seconds, the square lifter was 3.1 seconds, and both the large triangle and hexagon were 0 seconds. The alternative hypothesis stated that if the small triangle was used, it would fly higher than the large triangle, which was used as the control. This hypothesis is partially supported because the small triangle performed the best out of all the shapes. The T-Test showed that the differences in the times the lifters shook is statistically significant (P<.05) based on geometric shape. Further research can include whether it is possible to make an ion craft that can lift its power source, which would be necessary if they were used for transportation.
<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>901J10</td>
<td>Aceron, John Tyler</td>
<td>The Impact of Different Building Materials on Wi-Fi Signal Coverage</td>
</tr>
<tr>
<td>902C10</td>
<td>Bowman, Hannah</td>
<td>The effect of chlorine in swimming pools on swimsuit fabric durability</td>
</tr>
<tr>
<td>903F10</td>
<td>Hood, Katherine</td>
<td>The effect of the type of roof vent on the temperature of a house.</td>
</tr>
<tr>
<td>904P10</td>
<td>James, Esther</td>
<td>Effectiveness of Airbags in Preventing Fatalities in Vehicle Crashes</td>
</tr>
<tr>
<td>905W10</td>
<td>Saikumar, Aishwarya</td>
<td>Determining if CF 680 Maleimide subjected to near infrared light can be used to kill tetrahymena pyriformis as basis for alternative cancer treatment</td>
</tr>
<tr>
<td>906F10</td>
<td>Shen, Kevin</td>
<td>The effect of monocot and dicot plants on the phytoextraction of salt.</td>
</tr>
<tr>
<td>907B09</td>
<td>Sumathipala, Adriel</td>
<td>Biofuel Cells Made with Nanoparticles and Enzymes for Bioimplants and Biosensors</td>
</tr>
<tr>
<td>908S10</td>
<td>Triola, Marissa</td>
<td>The Effect of a Varied Projectile on Pine Wood and the Relationship of the Diameter of the Hole Corresponding with the Place of Impact</td>
</tr>
<tr>
<td>909D12</td>
<td>Tucker, James</td>
<td>Different Camera Housings on the Efficiency and Function of Nighttime All-Sky Meteor-Detecting Cameras</td>
</tr>
<tr>
<td>910W12</td>
<td>Vanderlyn, Lindsey</td>
<td>The Effect of Solvent on the Mechanical Strength of Electrospun Natural Biopolymer Meshes Containing Salts</td>
</tr>
<tr>
<td>911P10</td>
<td>Watson, Christopher</td>
<td>How Permanent are Permanent Markers?</td>
</tr>
<tr>
<td></td>
<td>Wright, Scott</td>
<td></td>
</tr>
<tr>
<td>912G12</td>
<td>White, James</td>
<td>Enhancing Kevlar Body Armor by Impregnating it with the Iron Sulfide Greigite</td>
</tr>
</tbody>
</table>
Page intentionally left blank.
The Impact of Different Building Materials on Wi-Fi Signal Coverage

John Tyler Aceron

The purpose of this experiment was to determine the impact of different building materials on 2.4 GHz Wi-Fi signal coverage. The results help understand how materials impact signal strength; this information can improve the design of coverage in buildings. To verify material impact, a test Wi-Fi transmitter and receiver were placed on opposite sides of different building materials. The control group consisted of air with no barriers. The independent variables were the building materials found in homes and schools to include combinations of wood, aluminum, metal, glass, stone, drywall, carpet, brick and concrete. The dependent variables were the measured signals reported by the receiver after passing through building materials. Materials recording higher signal losses were brick, stone, cement, concrete, and metal; These materials reduced signal strength by 6 to 12 dB (decibels) compared to the control variable (air) with a mean of power of -36.9 dBm (decibels relative to one milliwatt). The material with the highest loss of 12.6 dB was double paned glass. The remaining materials, typically more insulating showed signal losses up to only 4 dB. The data shows significance because of the difference in signal strength after passing through different material types. A One-Way ANOVA test was performed, resulting with a p-value of 4.72E-49. This confirmed that the null hypothesis is rejected and supported the alternate hypothesis that building materials impacted the dependent variable of signal strength. For future experiments, the signal type itself can be changed to see how it affects signal loss in materials.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of chlorine in swimming pools on swimsuit fabric durability

Hannah Bowman

When buying swimsuits, the consumer wants to pick the best suit. One that is cost-effective. If companies leave out key information about each fabric, then the consumer cannot make a good decision. The purpose of this research is to determine the most durable swimsuit fabric. If the consumer is aware of the most durable fabric, then they can make a cost conscious choice. The original size of each fabric sample was 10cm by 10cm. The elasticity was stretched by stretching each fabric using a one kilogram weight. The size of the fabric sample would be tested before and after attaching the weight. The fabric would then be submerged in water in the designated chemical environment for one hour. After time elapsed, the elasticity would be tested again, and the sizes would be documented. Transparency was measured using a Vernier Measuring System. The fabric was held over a light detector, and the amount of light that passed through was measured in lux. This was done before all testing began and after the testing had been completed. The hypothesis stated that a suit made up of 100% polyester would be the most durable. The results supported the hypothesis. The fabric maintained its elasticity the best, with only a 25% to 40% change. Other fabric samples experienced anything from XX% change to YY% change. For this variable a lower degree of variance was desired. For size, changes up to 6% were documented. With further experimentation, there might be more change due to the corrosive chemicals. When the transparency was tested, all three samples from 100% polyester read zero lux, meaning that no measurable amount of light was able to pass through the samples.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of the type of roof vent on the temperature of a house.

Katherine Hood

It is very important for homeowners to choose the most effective type of roof vent. By doing so, a homeowner can save a lot of money on air conditioning costs. It is predicted that houses vented with power vents, gable vents, ridge vents, and no ventilation systems, the houses with power vents will have the lowest rise in temperature. Therefore, homeowners of houses with a power vents will have to pay for less air conditioning than homeowners of houses with gable vents, ridge vents, or no ventilation systems. Power vents are the only type of roof vents that are powered by electricity. However, the cost of powering a power vent is significantly less than the cost of air conditioning for a house with a less effective roof vent. When tested on model houses, power vents are significantly more efficient at cooling a house than gable vents or no ventilation systems. Power vents and ridge vents have approximately the same efficiency at cooling the model houses tested.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Effectiveness of Airbags in Preventing Fatalities in Vehicle Crashes

Esther James

Airbags, a vehicle safety feature required to be installed in vehicles manufactured after 1999, have an effect on reducing the number of fatalities caused by vehicle crashes. This project shows the level of the effectiveness of airbags. The number of fatalities is dependent on the number of years since frontal airbags were made mandatory. The number of fatalities from five years before and five years after the airbags requirement demonstrates the effectiveness of airbags. The number of fatalities caused by vehicle crashes has been decreasing by approximately seven deaths per year. The percentage of fatalities due to vehicle crashes had decreased by 0.02 percent since frontal airbags were made mandatory by the government. The hypothesis that the number of fatalities caused by vehicle crashes will decrease after 1999, when airbags were made mandatory in vehicles, was supported by the data and a statistical t-test. The t-test shows the difference in the number of crashes from the years before and after 1999 to be significant. Further research could explore the effectiveness of seat belts, another vehicle safety feature, and compare vehicle crash statistics before and after seat belts were made mandatory.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Determining if CF 680 Maleimide subjected to near infrared light can be used to kill tetrahymena pyriformis as basis for alternative cancer treatment

Aishwarya Saikumar

Traditional cancer treatments kill many healthy cells, causing numerous side-effects. This research attempts to rectify the issue by establishing a basis for an alternative cancer treatment, using a process called the 'photodynamic therapy.' Using this therapy, cancer cells can be selectively destroyed, while the healthy cells are not damaged. This therapy uses CF 680 maleimide that will make the cancer cells react to a Near Infrared light. When injected, these photosensitizing agents accumulate and stay longer in the cancer cells. In theory, the near infrared will activate the CF 680 maleimide accumulated in the cancer cell and will destroy them. The protozoa T. pyriformis will be used as a model for cancer cells. On a microscope slide, the protozoa T. pyriformis will be observed and the amount of live T-pyriformis combined with the CF 680 maleimide will be counted. The slide will be placed under Near Infrared light for 15 minutes and the decrease percentage will be determined. The average percent decrease of the live T. pyriformis was 39%, respectively. As a control, the protozoa T. pyriformis will be examined independently with no CF Maleimide or near infrared light. From the data collected throughout the experiment, the treated culture of T. pyriformis with NIR group was statistically different from the control with a P less than 0.01. P equal to 0.00, df equal to 13, and T value is 1.771 for significance. The findings from this experiment could possibly translate over to cancer cells, meaning that this treatment could be used to target and treat solid tumors. While more research must be conducted regarding biocompatibility, this research can suggest that there is a foundation for such a treatment.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of monocot and dicot plants on the phytoextraction of salt.

Kevin Shen

This experiment tested the rate of phytoextraction of NaCl between two types of monocot and dicot plants to determine which type is most effective. Knowledge from this experiment helps agricultural specialists and farmers working on plantations near a body of ocean water. With the polar ice caps in the Arctic Ocean melting and sea levels rising, salt water contamination of the soil is becoming a big issue. The results from this experiment will show which type of plant executes best against NaCl. It was expected that the dicot plants will be more effective than the monocot plants. For this experiment, two monocot plants; corn-dent and barley, as well as two dicot plants; pea-thomas laxon and red-radish were used. Plants were placed in cups of equal size and allowed to grow for thirty days. After thirty days, the plants were contaminated with 327 dS/m of NaCl, the equivalent to sea water. The plants were allowed 3 days to extract the NaCl before the salinity was measured. There was no difference between monocot and dicot seed extraction and thus the null hypothesis was accepted.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Biofuel Cells Made with Nanoparticles and Enzymes for Bioimplants and Biosensors

Adriel Sumathipala

The future of personal healthcare opens many possibilities for early prevention and therapeutic intervention with implanted biomedical devices. These devices could potentially reside inside an artery or organ to continuously monitor internal biological status and alert or take corrective action. Such in-vivo bioimplants/biosensors require an electrical power source. Glucose could be harnessed as a fuel to provide this energy.

This research investigated a biofuel-cell made with enzyme-catalysts and nanoparticles. Biofuel cells were made of glucose-oxidase/catalase anode and laccase cathode. To facilitate the transfer of electrons generated by the oxidation-reduction reaction at the enzyme active sites, four biofuel cells were tested by loading the electrodes with carbon-nanotubes (long and short) and graphite and silicon particles. From voltage and current measurements, the power generated by the biofuel-cell for a 0.05 mol/l glucose solution was determined.

The mean output power for the biofuel-cells of long carbon-nanotubes, short carbon-nanotubes, graphite, silicon, and control (no conducting particles) were 90.11 µW, 1.39 µW, 0.17 µW, 0.13 µW and 0.04 µW, respectively, and have statistically significant differences as confirmed by an ANOVA test (P<0.05). A t-test (P<0.05) supported the alternative hypothesis that the output powers for the biofuel-cells with conducting particles is higher than the control.

The size and geometry of the additive particles influenced the generated power with long carbon nanotubes giving the best performance likely due to its smaller diameter and longer length that facilitates more efficient electron transfer. Further research will investigate improvements in electrode fabrication to increase reaction surface area and electron transfer.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of a Varied Projectile on Pine Wood and the Relationship of the Diameter of the Hole Corresponding with the Place of Impact

Marissa Triola

The purpose of the experiment was to determine whether the varied projectiles would create different diameters on impact with pine wood.

The type of ballistics used was impact ballistics, which is the study of projectiles striking an object(s). The main idea of the experiment is to determine which projectile created the smallest hole in comparison to the control.

The IV in the experiment was the variation on the projectile. The DV of the experiment was the diameter of the hole created when the projectile made direct contact with the pine wood. Group A is the control of the experiment and is a 9mm luger as are the rest of the projectiles used, group B is a hollow point and group C is a hollow point with a differing grain count and group D is a frangible.

The distance between the barrel of the firearm, a Glock 17, and the plywood will be measured and will remain at the same distance for each discharge of the firearm into the pine wood. The hole made upon impact is then recorded after the firing of the projectiles.

The statistical tests or t-tests show that the control and experimental groups have a significant difference (P<0.05). The holes made upon the impact of the IV’s on the wood were significantly smaller in comparison to the control thus rejecting the null hypothesis.

Further studies could show the differences of the caliber of the projectile on how large or small the hole made upon impact is.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Different Camera Housings on the Efficiency and Function of Nighttime All-Sky Meteor-Detecting Cameras

James Tucker

Surveillance of meteors is a subject of interest for numerous amateur astronomers. Monitoring of the sky involves cameras, or imagers, to photograph meteors at night. These pictures are collected in a database and analyzed to validate or reject supposed occurrence of meteor showers in space. The intent of this research was to determine if a newly designed camera housing could be constructed that was as cheap, efficient, and functional as the standard camera housing used for this purpose.

A standard camera housing and a newly engineered camera housing were compared by running an imager inside each type of camera housing for ten nights of clear weather. Data from each housing was collected and analyzed to determine meteor visibility as produced by the imager in each housing. All ten photos downloaded from the imager in both housing’s showed photos of meteors which were of similar quality.

The engineering goal of creating a cheaper housing that would produce quality images for analysis was met. This housing worked as well as the more expensive commercial housing in allowing the camera to capture quality images. Hence, the main difference between the newly designed housing and the standard housing is price. The ability to construct protective camera housings at a more affordable cost would encourage more amateur meteor watchers to use meteor surveillance cameras and become involved in monitoring the skies joining the network of amateur astronomers.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Solvent on the Mechanical Strength of Electrospun Natural Biopolymer
Meshes Containing Salts

Lindsey Vanderlyn

Wound dressings are important in the management of open wounds because they help prevent bacterial colonization, which interferes with the healing process. Electrospun gelatin meshes are especially suited to wound dressings because of their high porosity and ability to act as a good barrier. I created electrospun meshes from pristine gelatin/formic acid solutions (15 wt% gelatin) and solutions with sodium salts with different anions (NaCl and NaBr) added at three different concentrations (0.5 wt%, 0.75 wt%, 1.0 wt%). I am comparing these control and experimental meshes to determine the effects of the anion of the salt and the salt concentration on the formation of spider-net links and mechanical strength, comparing these to similar gelatin/acetic acid meshes I spun last year. I hypothesized that using formic acid, a more common solvent for gelatin, would increase the amount of spider-net links, and thus, the mechanical strength, providing applications for stronger wound dressings. In the meshes I have completed spinning, I have found that formic acid leads to greater spider-net link formation, but the meshes themselves are much thinner, with greater variation in thickness within a mesh, and have a lower mechanical strength. I am continuing to gather additional data.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
How Permanent are Permanent Markers?

Christopher Watson
Scott Wright

The purpose of our experiment is to determine the best way to remove the lasting mark of the permanent marker. Our hypothesis is “If permanent marker ink is used on different types of materials, then it will be possible to remove the ink completely or to some degree through the use of solvents.” We tested various chemical solvents such as acetone, hydrogen peroxide and bleach on various, common materials such as wood, carpet, plastic and glass. We tested for efficiency, damage to material, ease of use, and safety. The independent variable is chemical used to remove the mark and material used to remove the mark. The dependent variable is the effectiveness of removing permanent ink from the surfaces of different materials while avoiding causing damage to the materials. The brand and type of permanent marker along with the amount of pressure applied scrubbing during each test remained constant. The experiment took around 8 hours to complete. Our results varied for each chemical solvent and we came to the conclusion that the more porous the surface, the more the colorant can soak in, and the more the resin can bind to it, thus making the stain harder to remove. The results of our experiment showed that the product “GOOF OFF” was the most effective, avoided damage to the material and was the easiest and safest to use. Our results supported our hypothesis in that it is possible to remove permanent marks completely or to some degree.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Enhancing Kevlar Body Armor by Impregnating it with the Iron Sulfide Greigite

James White

In 2003, the scaly-foot snail, or Crysomallon squamiferum, was discovered to have greigite in its shell. This greigite was found to have irregular crystals which crack around particles, effectively dissipating force over a large area and preventing large cracks from forming. This inspired a study to determine if the strength/mass ratio of Kevlar could be improved. If Kevlar was imbued with greigite, it could become a stronger and more efficient form of body armor. Greigite was formed by mixing 100 mL each of .2M Sodium sulfide and .15 Mohr’s salt solutions. Hydrous and anhydrous greigite was formed by heating half of the greigite to remove water. The greigite was mixed with 250 mL of water, and a sample of Kevlar was added. The mixture was boiled to evaporate the water and infuse the Kevlar with greigite. Untreated Kevlar was boiled to be consistent with other tests. The samples were subjected to a drop test to determine the force at which the samples would break. Based on previous results, it was determined that Kevlar imbued with anhydrous greigite had a much stronger strength/mass ratio than regular Kevlar or Kevlar with hydrous greigite. To test the compound effect greigite in Kevlar armor, layers of Kevlar were to be tested at the same time. All three test samples were tested with 5 layers of Kevlar instead of one to see if the same effect would be evident in actual body armor. Results are still being gathered on these tests.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
## Energy & Transportation (1000)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001D12</td>
<td>Bebek, Corinne</td>
<td>Analysis of Boiler Room Energy Efficiency Using Ultrasonic Technology</td>
</tr>
<tr>
<td>1002B09</td>
<td>Burcham, Joseph</td>
<td>The Effect of the Amount of Sodium Chloride on the Rate of Electrolysis</td>
</tr>
<tr>
<td>1003C10</td>
<td>Colyer, Dalton</td>
<td>Efficiency of Primitive Fire-Starting Methods</td>
</tr>
<tr>
<td>1004D12</td>
<td>Donovan, Adam</td>
<td>The Effect of Various Shaped Solar Concentrators on the Efficiency of Solar Energy Output</td>
</tr>
<tr>
<td>1005B10</td>
<td>Fackler, David</td>
<td>The Effect of Different Fin Configurations on the Altitude Achieved During Flight</td>
</tr>
<tr>
<td>1006B12</td>
<td>Kurup, Sanjana</td>
<td>Varying Phosphorus Concentrations and Extraction Procedures in Lipid Quantification of Scenedesmus quadricauda</td>
</tr>
<tr>
<td>1007B09</td>
<td>Merizian, Jacob</td>
<td>The Effect of Different Concentrated Photovoltaic Designs on Electrical Output.</td>
</tr>
<tr>
<td>1008D12</td>
<td>Morsch, Robert</td>
<td>The Enhancement of Wind Energy Production via Nitinol Wire Properties</td>
</tr>
<tr>
<td>1009W12</td>
<td>Singh, Manrahat</td>
<td>Wind Turbine System Used To Power The Battery Of An Electric Car</td>
</tr>
<tr>
<td>1010J10</td>
<td>Vemulapalli, Kireeti</td>
<td>A Comparison Between Volts Produced by Solar Energy and Wind Energy</td>
</tr>
</tbody>
</table>
Analysis of Boiler Room Energy Efficiency Using Ultrasonic Technology

Corinne Bebek

Increasing energy efficiency is a focus of many companies and establishments. Greater energy efficiency is more cost-effective and it helps to create healthier environments. A major source of energy leaks and loss in facilities is leaky pipes. Ultrasonic detection of leaks was devised as a result of the space shuttle Challenger disaster. By using this same type of technology to detect leaks and electric anomalies, money lost as well as carbon footprints can be determined.

The purpose of this research was to find leaks present in several schools and the Ashburn Ice House and to calculate the money loss due to these leaks. Four schools and Ashburn Ice House were scanned using an ultrasound probe and five leaks were found in one school and eight were located at the Ice House. An estimate of the total additional cost as a result of the leaks was $157.70 and $482.78 in the school and Ice House respectively. These figures may vary based on the amount of time the machines run and fluctuation in energy prices. As a result, it is suggested that the novel use of this ultrasound technology is warranted in order to save money and maintain low energy costs. The probe’s cost is marginal when compared to savings. Further research would employ the probe’s use on a large scale. Had it been used to scan the electrical units which provided energy for the Super Bowl, the blackout would not have occurred.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of the Amount of Sodium Chloride on the Rate of Electrolysis

Joseph Burcham

Many oil companies and automotive companies are in a race to find a sustainable alternate energy source, and with electrolysis this may be possible. Oil and natural gas as you may know is a nonrenewable energy source and will eventually, one day run out. Hydrogen is a possible alternative to this problem. Hydrogen comes in numerous forms, one of which being water, which can be separated through the simple process of electrolysis. Electrolysis occurs when an electric current is sent through water, causing the hydrogen and oxygen atoms to be split. The focus of my study was to decide if salt increases the rate at which electrolysis occurs. Water was placed in a glass jar with two electrodes submerged in the water. A 6 Volt electric current was then run through the water, and hydrogen atoms appeared on one electrode and oxygen atoms on the other. When salt was added more electrolysis occurred, thus suggesting that salt is beneficial to the rate of electrolysis. I then repeated the experiment with a higher voltage, which produced a larger amount of bubbles of each element. Therefore, my research and experimentation suggest that if a high voltage is run through water and salt is present, then the hydrogen may be contained and sent to a possible combustion engine which powers an automated vehicle or engine with a specific task. This hydrogen source is a sustainable energy source which produces no harmful byproducts to the environment. This experiment will contribute to further research on this and similar topics.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Efficiency of Primitive Fire-Starting Methods

Dalton Colyer

The purpose of this research was to determine the efficiency of different primitive fire-starting methods. They are the bow-and-drill, hand-drill, fire-piston, and ferrocerium rod (control group) methods. The hand-drill and bow-drill were tested with three types of wood as the spindle; northern white cedar, willow, and yellow birch. Based on the research done before the experiment, the fire-piston should be the most efficient primitive fire-starting method, and the cedar should be the best wood for the bow-drill and hand-drill methods. The results that were collected were time elapsed (after 60 min. the attempt is stopped and deemed a failure), effort score (1-4), and success (was a fire lit?). The timer was started and the attempt began with whichever method. After an ember was obtained and then a flame was coaxed out of it, the effort score was recorded (unless of course the allotted 60 min. expired). The fire-piston was the best primitive fire-making method overall, with a low effort score of 2 (relatively comfortable) and only took about 2 minutes to achieve a flame. The hand-drill method with birch was the worst, failing on both attempts and also obtaining an effort score of 4 (exhausting). The bow-and-drill and hand-drill methods were most effective with cedar, and performed reasonably with the willow, the softer woods. From that, it can be concluded that the fire-piston is the best overall primitive fire-starter, and that the hand-drill and bow-and-drill methods are most effective with softer woods like cedar.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Various Shaped Solar Concentrators on the Efficiency of Solar Energy Output

Adam Donovan

Solar concentrators increase efficiency of photovoltaic cells and solar panels. Solar farms that use solar panels to generate energy utilize these solar concentrators. They reflect the sunlight to one focal point and are placed at that focal point when its location is determined. This increases the energy output of the solar cells.

The purpose of this research was to determine whether changing the shape of the solar concentrator had any resulting effect on the energy output of the solar panel. Three different, three-dimensional shapes were created; a parabolic semi-sphere, a rectangular pyramid, and a rectangular prism. The three differently shaped solar concentrators were used in conjunction with a solar panel. The voltage and amperage were measured at the same time each day for three days. Statistical analysis via a t-test indicated that the null hypothesis, that there would be no difference in the energy output for the different shapes, was rejected. The change in the shape altered energy outputs. The most efficient shape for solar collection was the parabolic semi-sphere which yielded the most energy output followed by the rectangular pyramid and then the rectangular prism. Further research would determine whether other solar concentrator shapes would be more effective energy collectors or whether seasonal differences in energy outputs exist. Determining how to raise the solar panel energy collection efficiency point so that extreme temperatures do not inhibit energy outputs of the solar cell would be beneficial in optimizing solar panel energy output for cleaner energy production.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Different Fin Configurations on the Altitude Achieved During Flight

David Fackler

The aerospace world needs to know the optimum number of fins in order for suborbital rocket missions to be carried out most efficiently. In the experiment three fin configurations, with varying numbers of fins, were tested against a four and six fin configuration to determine which reached the highest altitude (meters). The altitude (meters) was measured by using an altimeter device as the payload. The independent variable was the number of fins; three, four, or six, mounted on the rockets. The rocket components (except the fin configuration), assembly equipment and launch equipment was constant. The average altitude achieved by the three fin configuration was 120.6 meters, the four fin configuration average altitude achieved was 115.6 meters, and the six fin configuration had an average altitude of 113.5 meters. The ANOVA and t-tests were conducted on the recorded data and the three fin configuration consistently reached the highest altitudes and the hypothesis was proven to be correct. The three fin configuration was statistically not greater than the four fin configuration (P>0.05) and was greater than the six fin configuration (P<0.05) as determined by t-tests. The increasing amount of fins resulted in more drag on the rocket, preventing the six fin configurations from maintaining the higher altitudes of the three fin configuration. Further research could explore optimal fin design or optimal fin material to increase optimal aerodynamics.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Varying Phosphorus Concentrations and Extraction Procedures in Lipid Quantification of Scenedesmus quadricauda

Sanjana Kurup

Harsh environmental conditions have given rise to two major problems: the depletion of fossil fuels and eutrophication, the influx of nutrients into bodies of water resulting in anoxic aquatic environments. Microalgae are capable of combating both of these problems by possessing lipids that can be broken down to form biofuels, and providing dissolved oxygen to oxygen-deprived areas through the process of photosynthesis. The purpose of this project is to use Scenedemus quadricauda, a microalgae, to maximize lipid production by varying nutrient concentration and varying extraction technique. S. quadricauda was grown in phosphorus-rich and phosphorus-deficient conditions and then extracted mechanically via sonication and chemically using a Bligh and Dyer method. Varying relative concentrations of algae were used to show the direct correlation between algae concentration and lipid values. Preliminary results have shown a statistically significant difference between the amount of lipids produced among sonicated S. quadricauda and corn oil standards (P values of 0.54, 0.009, 0.002, 0.009 for 4 separate concentrations of algae and standard lipids dissolved in dimethyl sulfoxide/methanol solvent). Research continues in comparing the efficiency of the extraction methods as well as the impact of nutrient content on lipid value.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Different Concentrated Photovoltaic Designs on Electrical Output.

Jacob Merizian

This experiment will test the different parabolic concentrating designs on the photovoltaic (PV) cell power output. The independent variable was the change in designs of PV concentrators. The dependent variable was the PV cell power output in watts. The control was the PV cell without any concentrators. The power output of the PV cell was measured by a multimeter to measure the voltage and wattage, then multiplying to get the wattage. The PV cell power output using the concentrators was compared to the ones without. The means of the control, smooth reflective and multi-mirrored groups' power output were .376, .778, and 1.528, respectively. One-way ANOVA was used to compare the power output means of the three groups. The alternative hypothesis of using multi-mirrored and smooth reflective parabolic concentrating dishes will increase the PV cell power output more in the multi-mirrored dish. It was supported by a significant F-statistic with p = .000, indicating a significant power output means difference among the PV cell groups. The increase in the power output mean in the multi-mirrored group was found to be statistically significant, but it was not for the smooth reflective group using the Bonferroni correction for the post-hoc multiple comparisons. The weather was considered a random error source. Further research could explore the effect of the mirrors' size and angle on the PV cell power output. It is recommended to repeat this experiment in the summer days, considering using a better quality multi-junction cell and mirrors.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Creating affordable energy while minimizing the creation of pollution are daily problems experienced across the globe. Developing energy sources to make life comfortable while minimizing pollution is an obvious goal for many of today’s engineers. The purpose of this research was to determine whether the metal nitinol could be used for energy creation. Nitinol’s anomalous property of remembering a shape when heated was implemented in this goal. Using an erector set, two wheels were attached to a metal column one above the other but not touching. A length of nitinol was connected using small eyelets and looped around the wheels in a track constructed on the wheel. When a container of hot water was placed under the lower wheel touching the wire, the wheels moved after an initial push. This was due to the fact that nitinol, when it made contact with the hot water, it attempted to straighten thus pulling the following wire which in turn pulled wire out of the water. This, in turn, moved the wheels. Nitinol is a metal alloy made of tin and nickel, two of the most abundant and inexpensive metals. This device harnesses the properties of nitinol, further research would entail correcting balancing in the device and decreasing friction. A large scale device could yield large amount of energy. Hence if nitinol wire was paired with wind turbines affordable clean energy could be produced.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Wind Turbine System Used To Power The Battery Of An Electric Car

Manrahat Singh

As the supply of fossil fuels slowly decreases every day, scientists are on a mad dash to implement alternative energy sources to cars. Many alternative energy sources, such as fuel cell, ethanol, and electric have been implemented. However, wind energy has been neglected. This experiment tested a wind turbine at different wind speeds to determine the amount of electricity it could produce and if it could increase an electric car’s driving range. The IV was the different wind speeds that the turbine was tested at. The DV was the amount of electricity produced by the wind turbine. The lowest wind speed that the turbine was tested at (5 mph) was used as a control. The wind turbine was placed in an enclosed area which simulated its operating conditions. The amount of electricity produced was recorded using a voltmeter. Wind speed was recorded using an anemometer. The wind turbine was able to produce 1.354 volts at 5 mph, 1.601 volts at 7.1 mph, and 1.847 volts at 8.9 mph. Using these values, it was projected that the wind turbine could produce up to 22.6% of the electricity needed to charge the battery of an electric car. The alternative hypothesis was supported and the null hypothesis was rejected because the ANOVA test gave a p value less than 0.05. The IV and DV had a positive relationship. Further research can be done by implementing a system of wind turbines to an electric car.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
A Comparison Between Volts Produced by Solar Energy and Wind Energy

Kireeti Vemulapalli

Fossil fuels pollute the world every day and cause many problems that damage the environment. This experiment identified the better renewable resource to use in a residential home when comparing solar and wind energy. This energy source can eventually lead to converting residential homes to clean, renewable energy. Independent variables for experiment were wind energy and solar energy. Dependent variables are the number of volts produced. The wind turbine was mounted to the roof and connected to a voltage data logger. These steps were repeated for the solar panel and connected to port #2 on data logger. The sampling rate was set for both the wind turbine and solar panel for 50/second and the recording time set for 120 hours. After conducting the experiment, the results showed that in Sterling, VA, solar energy produced more volts than wind energy. The mean number of volts solar energy produced was 6.9 volts day and night. Wind energy was only able to produce a mean of 1.2 volts. The experimental hypothesis was supported.

The results of the experiment are df = 9, t = 1.93, Level of Significance less than 5% (.05) and therefore, the null hypothesis is rejected. Further research could explore varying results depending on location, season, and different energy brands. Running the experiment for a longer amount of time would produce more accurate results as it include a higher sample. This project was important to renewable energy and can lead to significant discoveries in the future.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
### Environmental Management (1100)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1101L12</td>
<td>Broshkevitch, Cara</td>
<td>A Future with no Landfills</td>
</tr>
<tr>
<td></td>
<td>Richards, Anne</td>
<td></td>
</tr>
<tr>
<td>1102S09</td>
<td>Choo, Alyssa</td>
<td>The Effect of Phytoremediation on the Reduction of Nitrate Levels in Water.</td>
</tr>
<tr>
<td>1103C10</td>
<td>Coughlin, Rachel</td>
<td>The Effect of Redistributed Food Items on the Amount of Food Waste in Schools</td>
</tr>
<tr>
<td>1104C10</td>
<td>Jones, Matthew</td>
<td>Algal Growth of Chlorella Algae in a Photobioreactor Under Various Lighting</td>
</tr>
<tr>
<td>1105L12</td>
<td>Miller, Alec</td>
<td>Determining the Effectiveness of the Garden Cress Lepidium sativum as a Phytormediator for Aqueous Copper</td>
</tr>
<tr>
<td>1106D12</td>
<td>Rahmani, Yasamin</td>
<td>Creation of a Water Collector for Third World Countries via Namib Beetle (Stenocara gracilipes) Exoskeleton Design</td>
</tr>
<tr>
<td>1107L11</td>
<td>Vaillancourt, Lana</td>
<td>The Impact of Nitrogen on Bioremediation of an Oil Spill</td>
</tr>
<tr>
<td>1108H12</td>
<td>Vermeland, Michael</td>
<td>The Optimization of Surface Characteristics Through the Change of Relative Humidity in Oder to Effectively Fog Harvest</td>
</tr>
</tbody>
</table>
Page intentionally left blank.
High-density polyethylene plastic (HDPE) is used for many everyday items such as grocery bags: the top consumer item in the world. When disposed in landfills, this plastic takes over 100 years to degrade, filling up the landfill space, slowing the degradation of other substances, and blocking groundwater collection. Phanerochaete chrysosporium fungus and the bacteria Pseudomonas putida and Sphingomonas macrogoltabidus have been shown to biodegrade low-density polyethylene plastic in a natural environment and, prior research established that the microbes could also use high-density polyethylene plastic as their sole carbon source. The ratios of P. chrysosporium fungus, P. putida bacteria, and S. macrogoltabidus bacteria have been manipulated to maximize the biodegradation of UV and thermal pretreated plastic. It was predicted that the optimum combination of microorganisms would include P. putida bacteria since past research identified it as the major factor of biodegradation. Biodegradation rates have also been found to be higher after exposure to a combination rather than individual microorganisms. A second pretreatment using manganese stearate and a shorter thermal radiation has been investigated to identify a pretreatment requiring less electricity. Research is ongoing and all data will be collected by March 14th.
The Effect of Phytoremediation on the Reduction of Nitrate Levels in Water.

Alyssa Choo

The experiment tested the efficiency of the process of phytoremediation using Lemnaceae in reducing nitrate from the contaminated water, to bring it to acceptable maximum contaminant level (10 ppm) and to explore possibilities of using Lemnaceae as a natural decontaminant to treat sewage and agricultural wastewater containing excess nitrogen.

Nitrate is a significant contributor to water pollution and is a common ground and surface water contaminant. It leaches out of fertilizers, pesticides, sewage, septic tanks, wastewater, livestock farming, agricultural and industrial processes, and burning of fossil fuels adds excess nitrate to groundwater, which presents a risk to public health and causes eutrophication.

40 mg/L or 40ppm nitrate (control) was added to spring water as a pollutant. Lemnaceae (IV) was placed on the surface of water in experimental groups. The initial and final nitrate levels (DV) were recorded (ppm) for 3 weeks to determine the effectiveness of Lemnaceae in reducing nitrate levels.

The t-test showed a statistically significant difference (p<0.05) in final nitrate level after 3 weeks in control (without Lemnaceae, 40ppm) and experimental group (with Lemnaceae, 11.6 ppm- slightly higher than the MCL, 10 ppm, set by the EPA), thus supporting the alternative hypothesis.

Lemnaceae plants rapidly remove nutrients (minerals) and use them for their growth and may also sustain oxygen levels in water. Lemnaceae’s rapid growth rate, necessity for massive amounts of nutrients, ease of harvest, and temperature tolerance makes it a very effective solution for wastewater treatment.

Further research could test other plants, such as Lemna minor and Myriophyllum aquaticum, for their ability and efficiency to remove other minerals and metals from contaminated water and could explore the possibility of using these plants to treat sewage and agricultural and industrial wastewater.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Redistributed Food Items on the Amount of Food Waste in Schools

Rachel Coughlin

Schools are a major culprit of food waste. Kids bring or buy their lunch, only eat certain parts of it, and throw the rest away. This experiment was created to reduce the amount of food waste in schools and test my hypothesis, which is the amount of food waste will decrease in a lunch period if a trading table is available to the students. My procedure began with the collection of control data, where the amount of trash produced in the lunch period was weighed for ten days. Then the independent variable, the trading table, was inserted for the next round of data collection. The idea of the trading table is that students with food they do not want will place their unwanted food items upon the table, and hungry students will take it for themselves. The data supported my hypothesis, the amount of trash decreased when the trading table was made available, and because the P value was .05, meaning that the results have a 5% chance of occurring by chance alone. The average amount of trash per lunch period without the trading table was 122 kilograms, while the average amount of trash per lunch period with the trading table was 120 kilograms. This experiment is a wonderful discovery for the field of food waste. It is free, and readily available to the students, rather than composting which is costly, and waste-free lunches which are time consuming.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Algal Growth of Chlorella Algae in a Photobioreactor Under Various Lighting

Matthew Jones

The project investigates the algal growth of Chlorella algae in algae Photobioreactors when put under fluorescent, incandescent, red LED, green LED, and natural sunlight to assess which method would be the best for the production of algal biodiesel. The Photobioreactor module put the solution of water and algae into a continuous movement. The experiment was tested over a 16 day period in which four of the reactors were in individual compartments and one was set on top of the entire container.

After the 16th day the algae was extracted for the water. The algae under the fluorescent light grew more than any of the others at 1980 mg. The most surprising result was the green LED light Photobioreactor with only 850mg of algae after the testing period. This was because the algae pigment was green and reflected most of the green light that the diodes were emitting. Furthermore, the incandescent bulb was hot and therefore evaporated most of the water which would not be good for growing algae because you would have to refill the water constantly.

In a small scale experiments the fluorescent light would be the best type of light to grow algae. If I were to further my research I would further my algae selection to see which would grow the best in direct sunlight and how to modify my experiment to increase the biofuel output. Sunlight is an immense natural resource that can be harnessed by growing algae for biofuels.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Determining the Effectiveness of the Garden Cress Lepidium sativum as a Phytoremediator for Aqueous Copper

Alec Miller

Aqueous heavy metals from pipes and runoff such as copper can cause severe tissue damage and illness in organisms. In this experiment, the common garden cress Lepidium sativum was tested to see if it could act as a potential phytoremediator for aqueous copper. Groups of 25 L. sativum plants were grown hydroponically in controlled environments with a range of metal concentrations from 0 to 100 ppm to test the viability of L. sativum when exposed to copper. The results established that L. sativum was able to grow in copper concentrations up to 100ppm. Groups containing variable amounts of L. sativum (25, 50, or 75 plants per trial) were then grown in 50 ppm copper and samples of the water containing the heavy metal were taken over a 14 day time course for all plant number groups. The concentration of metal remaining in each individual sample was determined with a spectrophotometric assay. Copper concentrations decreased for all experimental groups over time and increasing the number of plants used to treat the 50 ppm copper solution resulted in greater copper removal. These and other experiments will be used to determine a mathematical equation to fit the relationship between copper concentration to be removed and the plant treatment time as well as the number of plants required. With this information, a remediation plan can be calculated for any copper contaminated water using the common garden cress, Lepidium sativum.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Creation of a Water Collector for Third World Countries via Namib Beetle (Stenocara gracilipes) Exoskeleton Design

Yasamin Rahmani

Many third world countries lack water in which to grow crops and for their people to live productive, sustainable lives. In addition, dehydration is one of the leading causes of child mortality around the world. In order to minimize drought impacts in these countries’ villages, a method must be devised to collect water during times when increased relative humidity that may exist.

The purpose of this research was to create a water collector mimicking the Namib beetle which collects water and rolls drops into its mouth. By constructing a collector based on the beetle’s exoskeleton structure, water collection in geographical locations experiencing low relative humidity may be feasible.

The constructed collector was placed 10 feet above the ground. After the a period of 32 days in which water was collected every 48 hours, the device was successful at collecting water during days of high humidity. Statistical analysis via the comparison of the average relative humidity vs. the amount of water collected by the device was measured and was determined that the collector would work best in locations that experience relative humidities of 70% or higher such as Belize, Macedonia and Fiji. Continued research would entail involve modifying the device and testing several different locations. By creating a device based on a natural water collector, the beetle, water can be pulled from the atmosphere and be available for areas stricken by drought.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Impact of Nitrogen on Bioremediation of an Oil Spill

Lana Vaillancourt

The purpose of this study was to determine the different amounts of nitrogen needed by naturally present microorganisms to rapidly reproduce and consume large concentrations of oil, resulting in less oil in the water. In this experiment, different ratios of powder nitrogen were added to four beakers that contained water from the Gulf of Mexico along with engine oil to simulate and oil spill. The samples were then monitored to see what impact the nitrogen had on the oil spill. The independent variable was the different amounts of nitrogen added to each test beaker; the beaker without any amount of nitrogen was the controls and the dependent variable is the level of oil after the experiment. The results found the more nitrogen added to the beaker, the higher oil reduction. The water samples without nitrogen had a consistent mean of 5, leaving no change in oil level. The 0.15 grams of nitrogen beaker had a mean of 4.59, similar to the mean of the 0.30 grams of nitrogen beaker which had a mean of 4.30. The beaker with 0.45 grams of nitrogen had a lower mean of 3.45, while the beaker with 1.00 grams of nitrogen had the lowest mean of 2.34. These results show that the beaker with 1.00 grams of nitrogen had the greatest reduction in oil level. The experimental hypothesis, that the naturally occurring algae could be made more rapidly reproduce and consume large concentrations of oil, with the addition of more nitrogen, resulting in less oil in the water, was supported in the experiment. Further research could explore the use of higher levels of nitrogen in the samples and a larger number of test beakers to show a larger scale of the oil decomposition by the microorganisms.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Optimization of Surface Characteristics Through the Change of Relative Humidity in Order to Effectively Fog Harvest

Michael Vermeland

There are places in the world in which frequent fog episodes occur resulting in brief periods of high relative humidity, but also have a shortage of usable water due to low annual precipitation. To take advantage of the abundance of fog, this project addresses this disparity by using varying hydrophobic solutions to capture water from the air. Each tested climate condition represents actual locations on Earth in which frequent fog episodes occur but also have a shortage of usable water. Two different established methods, copper acetate palmitic acid and ethanol and copper stearate, were chosen as hydrophobic surfaces and tested against each other under different relative humidities. Copper acetate palmitic acid raises off the polypropylene while the copper stearate lays flat, as demonstrated through scanning electron microscopy. The hydrophobic solutions were sprayed onto a hydrophobic polypropylene mesh using a nitrogen dispersion system and placed in an environmental chamber, exposed to varying relative humidities, and the beaded water that the mesh trapped was collected and quantified. t-Tests were run between the treated and untreated mesh after subtracting out background humidity. A statistically significant difference (p = 2.078 x 10^-4) exists between the amount of water collected. Preliminary calculations also demonstrate this method is 18 times less expensive than traditional desalinization methods. Data collection continues on the second hydrophobic solution, as well as incorporating transportation costs into the costs/savings analysis of traditional water purification methods.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
# Environmental Sciences (1200)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1201B10</td>
<td>Abbott, Caroline</td>
<td>Chemical Analysis of Paleo-Sediments From the Ecosystem of Extinct Sand Sharks</td>
</tr>
<tr>
<td>1202C10</td>
<td>Babbitt, Michelle</td>
<td>The effect of Eisenia fetida and Eisenia hortensis on effluent</td>
</tr>
<tr>
<td>1203C10</td>
<td>Cunningham, Jacob</td>
<td>Toxicity of Asphalt Sealants on Daphnia</td>
</tr>
<tr>
<td>1204S10</td>
<td>Das, Shivani</td>
<td>The Effect of the addition of calcium carbonate on the restoration of pH of an acidified body of water and the survival rate of Daphnia magna</td>
</tr>
<tr>
<td>1205B10</td>
<td>Draper, Savannah</td>
<td>The Effect of Wetland Placement on Polluted Water</td>
</tr>
<tr>
<td>1206P10</td>
<td>Harmon, Helena</td>
<td>Testing Nitrites and Nitrates in Virginia’s Water Systems</td>
</tr>
<tr>
<td>1207B09</td>
<td>Hasan, Qasim</td>
<td>The Effect of Limonene on the Recycling of Styrofoam Cups</td>
</tr>
<tr>
<td>1208D12</td>
<td>Kurnos, Julianne</td>
<td>Peroxide Delignification of Wood during Processing a Greener Chemical Method</td>
</tr>
<tr>
<td>1209J09</td>
<td>Lidwin, Jennifer</td>
<td>The Effect of New Construction on the Beautification of Neighborhood Ponds</td>
</tr>
<tr>
<td>1210V10</td>
<td>Ludwig, Madeleine</td>
<td>The Effect of Temperature Change on pH Level in Chesapeake Bay Water</td>
</tr>
<tr>
<td></td>
<td>Pendley, Sara</td>
<td></td>
</tr>
<tr>
<td>1211D12</td>
<td>Newman, Kara</td>
<td>Heavy Metal Filtration and Flocculation Using Banana Peels and Fruit</td>
</tr>
<tr>
<td>1212W12</td>
<td>Pondugula, Pushpak</td>
<td>The Effect of Liquid Type on Soil Absorption</td>
</tr>
<tr>
<td>1213P12</td>
<td>Tagliaferri, Robert</td>
<td>Testing for the Bioaccumulation of Strontium 90 in the Mollusks of Lake Anna</td>
</tr>
<tr>
<td>1214B10</td>
<td>Tifft, Reilly</td>
<td>The Effect of Salinity on Submerged Aquatic Vegetation Growth and Dominance in the Chesapeake Bay Tidal Zone</td>
</tr>
<tr>
<td>1215C10</td>
<td>Umstattdt, Kendrick</td>
<td>The Effect of Wind Speed and Topography on the Travel of Pollution Plumes</td>
</tr>
<tr>
<td>1216B09</td>
<td>Whimpenny, Christopher</td>
<td>The Effect of Housing Development Age on Soil Organic Carbon in Suburban Developments in Loudoun County, Virginia</td>
</tr>
</tbody>
</table>
Page intentionally left blank.
Chemical Analysis of Paleo-Sediments From the Ecosystem of Extinct Sand Sharks

Caroline Abbott

The purpose of this study was to determine the environment of an extinct and prehistoric shark species, by comparing it with a modern shark species, and thereby learn more about the geologic and ecologic history of the Chesapeake Bay region. This was done by testing for calcite in sediment samples taken from locations where both sharks were present by sprinkling sediment with hydrochloric acid. The independent variable was the type of sediment, the dependent variable was their reaction to the acid, and the control was the modern day Cayman sediment samples. All fifteen samples of Cayman and prehistoric sediments reacted strongly with the acid, so from the data gathered so far the experimental hypothesis has been proven. Said hypothesis was, “If from comparing sediment from where the teeth of the extinct sand tiger shark Carcharias hopei are found with sediment from where the teeth of the modern sand tiger shark Carcharias taurus are found, and it is discovered that the two are extremely similar, then it can be concluded that the area that the teeth of C. hopei were discovered in was at the time of deposition a warm shallow sea.” Though this one chemical test delivered some information to the original question, further research is needed to support the results more. Different and more detailed chemical tests and observations of the sediments could surely do just that, if increased and proper funding and materials were provided.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of Eisenia fetida and Eisenia hortensis on effluent

Michelle Babbitt

Of the two earth worms were used, Eisenia fetida and Eisenia hortensis, which displayed a greater capability for cleansing water (effluent)? The purpose of the study was to see if no worms, Eisenia fetida, or Eisenia hortensis cleans effluent better. Also, to support the idea of the Bio-filtro, Eisenia fetida cleansing abilities, and to show that Eisenia hortensis cannot perform the same function Eisenia fetida can. Three columns were set up. One had no worm, the other Eisenia fetida and the last Eisenia hortensis. Then effluent was sprayed on to each and then water samples were collected to see which one had a greater ability for cleansing effluent. The major finding were that Eisenia fetida has the greater capability for cleansing water, however, the water was not clean enough for it to be drinkable. Also, that Eisenia hortensis had no significant capabilities for cleaning water. If Eisenia fetida were used then there would be a smaller amount of contaminants than if Eisenia hortensis or no worms were used; that was the hypothesis. The hypothesis was accepted since the overall p values (found using the ANOVA statistical test) of each individual experiment showed that there was a significant difference in cleanliness between the groups (Eisenia fetida highest capability). Further research could include having a wider range of worms and a larger scale of tests done on the water samples in order for the data to be more complete and exact. The experiment is in the environmental science category.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Toxicity of Asphalt Sealants on Daphnia

Jacob Cunningham

Asphalt sealants have been shown to contribute to poor water quality. This experiment will determine if pavements with coal tar sealants are toxic to daphnia. The hypothesis states that runoff from pavements with coal tar sealants are toxic to daphnia, while runoff from pavements without coal tar sealants are not. Based on literature, the daphnia exposed to coal tar based parking lot sealant (independent variable) will be negatively affected (dependent variable) compared to the daphnia exposed to sealants that do not use coal tar.

Four 0.6 meter x 0.6 meter sections of asphalt were constructed of wood. Three types of asphalt sealant were obtained as the independent variable—2 year latex based sealant (2 year), latex-based airport grade sealant (airport), and coal-tar based parking lot sealant (coal tar). The control in this experiment was asphalt without a sealant. Toxicity was tested using runoff from the three sealant types. Each of the 4 experiments had three 1.9 liters (2 quart) containers with about 0.3 liters (10 ounces) of water in each to start the experiment, for a total of 12 containers. Daphnia were placed in each container and counted. "Rainfall" was distributed on each asphalt section and the runoff of each experimental “run” was collected to fill each Daphnia container.

The asphalt with no sealant, or the control, had no effect on the daphnia. Although black sediment from the 2-year sealant complicated the experiment, the water cleared after about two days, and all the daphnia were still alive. The Airport sealant had no effect on daphnia. The daphnia exposed to coal tar sealant survived initially, but began to die on the third day. The coal tar sealant test showed that runoff from asphalt sealed with a coal tar based sealant is toxic to daphnia.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of the addition of calcium carbonate on the restoration of pH of an acidified body of water and the survival rate of Daphnia magna

Shivani Das

The experiment investigated the effect of addition of calcium carbonate to prevent the detrimental effects of acid rain on the restoration of pH of acidified water bodies and survival rate of Daphnia magna.

Water is a renewable resource, however, the earth’s supply of fresh water is limited. Acid rain affects living creatures and chemical make-up of water resources resulting into water pollution. The addition of calcium carbonate releases elements phosphorus and carbon that are important for survival and growth of aquatic life.

Both control (spring water) and calcium carbonate treated (IV) experimental group were exposed to constant amount of acid rain. Survival of Daphnia at regular interval was recorded to determine the average drops (DV) tolerated by Daphnia in each group which was then correlated with percent survival rate of Daphnia in both groups. The t-Test and ANOVA show statistically significant difference (p<0.05) in the average acidic drops tolerated by Daphnia in control and 0.1g/1L calcium carbonate treated group. The experimental group had a higher average number of drops (187.66 drops, variance 1638.81) tolerated than control (141 drops, variance 797.14) and had a higher survival rate (73% alive) compared to control (0% alive) at 165 drops, due to stabilized pH.

The alternative hypothesis was supported indicating an increase in the percent survival rate in the calcium carbonate treated samples.

The effect of addition of calcium carbonate on soft and hard waters could be compared for further research. Soft waters have few basic ions, have a low buffering capacity to resist pH fluctuations, and are more susceptible to acidification hence do not support fish or plankton populations that are the basis of the food chain. The safety and the long-term effects of liming need to be explored.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Pollution is a ubiquitous problem in a world whose increasing population does not properly dispose of trash. Water pollution is especially prevalent and has hurt ecosystems around the world, including the Chesapeake Bay. Scientists are constantly looking for more effective and cheap ways to take common pollutants found in agricultural runoff, such as nitrates and phosphates from fertilizer, out of water.

In this experiment, different amounts of pollutants found in fertilizer were placed in three different wetlands containing Porella leiboldii, Salvinia molesta, Urricularia, Elodea Canadensis, and duckweed plants along with water and rocks. All three wetlands contained the same aquatic plants, amount of water, sunlight, and growth period. The nitrates and phosphate levels were measured on Day 0 and Day 15 of the experiment. The two different wetlands showed a statistically significant difference in the amount of pollutants before and after the experiment when compared to the control and when compared to each other (p<0.05). The presence of aquatic plants reduced the amount of nitrogen and phosphorous after fifteen days (p<0.05) as shown by a t-test. The alternative hypothesis that the wetland placement would have a positive effect on the amount of pollutants in the water was accepted.

This slight change in the amount of pollutants was caused by the aquatic plants in the wetland which lower the amount of pollutants in the water. Further research with cleaning polluted water using wetlands could use wetland animals along with plants and could test the effect of wetland placement on the polluted water for a longer period of time.
Testing Nitrites and Nitrates in Virginia’s Water Systems

Helena Harmon

The purpose of the ‘Testing Nitrites and Nitrates in Virginia’s Water Systems’ experiment was to see whether the nitrite and nitrate content in various water systems was higher in areas closer to pollution sources than in areas further from pollution sources. The hypothesis was that the areas closer to sources of pollution would have higher concentrations of nitrites and nitrates than areas further from pollution because the higher levels of pollution would increase the levels of nitrites which would increase the levels of nitrates. The null hypothesis is that the nitrite and nitrate levels are not affected by the proximity to the source of pollution, but rather, by the speed of the current. To conduct this experiment, four sources of water (a neighborhood pond, Horsepen Run Creek, the Potomac River, and Glencarlyn Creek) were selected, and tested using Tetra EasyStrips™. Five samples were obtained from each source, and then the data from the samples was collected and averaged. The results showed that the neighborhood pond, which had a nitrate average of 10ppm and a nitrite average of 1.0ppm contained the most nitrites and the second most nitrates. This supports the null hypothesis because although the pond is connected to Horsepen Run Creek, at the time and place of testing, the water was standing. In conclusion, this experiment showed that although Virginia’s water is safe, caution should be taken in any situation where standing water is involved because it is more likely to become harmful since the contents cannot diffuse.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Limonene on the Recycling of Styrofoam Cups

Qasim Hasan

The purpose for this experiment was to develop new eco-friendly ways to recycle Styrofoam. This was accomplished by using limonene, the substance that comes out of the rind of various citrus fruits.

The experimenter developed the idea of testing different fruit peels to determine if limonene would be a valid source to recycle Styrofoam. The test was conducted, each with a five-minute period, to see exactly how long it would take for the time of degradation to begin. The limonene was squeezed from the rind to five millimeters and poured onto the cup.

The data was divided into categories based on the different types of substance used during the experiment. The data showed that the rind of a citrus fruit could be a liable source to recycle Styrofoam, however the citrus fruit that did the most damage in the least amount of time was the orange. The null hypothesis had to be accepted due to the Pearson-r correlation, but future research could enhance these findings so that recycling Styrofoam becomes a thing of the norm in today's society.

The conclusions were that the limonene, in specific fruit’s peels, could be a good way to recycle Styrofoam, which causes serious environmental problems. The experiment also proved that limonene is only contained in the peel or some fruits, such as oranges, lemons, and limes.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Peroxide Delignification of Wood during Processing a Greener Chemical Method

Julianne Kurnos

Paper is one of the most widely used items in the world. From the production of writing paper to cardboard boxes, the paper industry makes $6.16 billion dollars per year. However, the production of paper, while cheap and efficient, can produce harmful pollutants such as carbon monoxide as a result of the reaction of chlorine and hydrogen peroxide used in the delignification process. These pollutants are extremely harmful to people and the environment.

The purpose of this research was to determine whether lowering the pH using sodium hydroxide during the delignification of wood would provide a cleaner method of wood processing. Three different pHs as well as a control were used to determine which pH caused the greatest loss of mass over a 12 hour period. A pH of 10, 11, and 12 were achieved by adding sodium hydroxide to a solution containing five grams of wood, 100 ml of hydrogen peroxide, and 100 ml of water. Each treatment reaction ran for six hours for two days. At the end of each day the wood was massed.

Statistical analysis via a t-test was conducted and the null hypothesis, that there would be no loss of mass due to raising the pH, was refuted. Each pH caused a significant loss in wood mass after the 12 hours. Further research would require constructing large scale vats for mass wood treatment and may reveal a new and greener way to create wood pulp in the production of paper products.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of New Construction on the Beautification of Neighborhood Ponds

Jennifer Lidwin

The purpose of this experiment was to demonstrate how the deterioration of water quality over time results in the decline of the survival of water fleas through decreased levels of oxygen saturation. The decreased levels are indicative of pollution caused by construction near neighborhood ponds.

In this experiment, the independent variable was time and the dependent variable was the water quality changing over time. The micron filtered water is the control. The water quality was measured by the survival of water fleas and the percent of oxygen saturation in the pond water. A container with 950 mL of pond water was collected. The control was used as the standard for comparison. For each trial, 40 water fleas were placed in each container. The survival of water fleas was observed and recorded after 24 hours. The control had an average survival rate of 27.4 out of 40 compared to 33.13 in pond water. Statistically significant mean differences were found between the control and the experimental sample, \( t(28)=9.448, p\text{-value} = 4.273, \alpha = .05 \). Thus, the null hypothesis, the mean of survival of water fleas is not significantly different from the survival of water fleas after 24 hours, is rejected. The experimental hypothesis, if the water fleas are placed in spring water, then they will survive longer than in pond water, is also rejected. In further research, since the temperature of water was different in the control and pond water, a study would include testing water fleas in different temperatures of water.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Temperature Change on pH Level in Chesapeake Bay Water

Madeleine Ludwick
Sara Pendley

The purpose of this experiment is to study the pH level in the Chesapeake Bay water. The manipulated experiment is the temperature, which will affect the pH of the water. This experiment studied the result of the temperature change on pH level. The independent variables were hot temperature (28.3°C) and cold temperature (20.5°C). The dependant variable was the change in pH level. The control group was the original (room) temperature and original pH level of the water. This experiment required to travel to Sandy Point in the Chesapeake Bay, and took the pH level and the temperature of the water, as well as taking the water home to manipulate the rest of the experiment. The experiment required to heat the water and take the temperature and the pH level then place the water in cold, iced water and take the temperature and pH level. Variation among column means is not significantly greater than expected by chance. Overall, the data did not pass the normality test with a P<0.05. With the P value being 0.2879, there were no post tests calculated because it was greater than 0.05.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Heavy Metal Filtration and Flocculation Using Banana Peels and Fruit

Kara Newman

Lack of access to potable water is a major problem throughout many parts of the world. Heavy metal pollution is prevalent in industrializing countries where industrial dumping is largely unregulated. Furthermore, the addition of untreated sewage to a water source can be a source of dangerous pathogens. Finally, there are countless other potentially harmful suspended particles. Dried and crushed banana peels have been shown to remove heavy metals from water, due to the presence of the hydroxyl and carboxyl groups, which are found in pectin in the peel. Furthermore, banana fruit is known to be a natural flocculant, removing suspended particles, including bacteria, from water. Solutions of 3 ppm zinc, copper, and lead, 1 ppm zinc, copper, and lead, and a solution of all three heavy metals were prepared. 300 μL of E. coli measured to an optical density of 0.5 at 600 nm were added to each solution, and the solutions were plated. Desiccated banana peels were stirred in each solution, and the initial turbidity of the solution was taken as a measure of water clarity. Banana fruit flocculation was performed and the solution was strained. The solutions were plated again to determine change in bacterial colony count after treatment and the final turbidity of the solution was taken. Spectrophotometric reagent tests were used to determine heavy metal concentrations. Data collection continues, but preliminary results show a decrease in heavy metal concentration and a decrease in solution turbidity after flocculation treatment. If successful, the implications of this project are a cheap, natural, and easily accessible water filtration method.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Liquid Type on Soil Absorption

Pushpak Pondugula

Blue drops drip from the hood, slowly traveling down the gradient of the garage and eventually ending their destination through a slow, but irreversible seepage into the surrounding soil. Antifreeze, a blue liquid, is not only a commonly mishandled pollutant but also a common pollutant that is disposed of incorrectly. The purpose of the experiment is to study how pollutants absorb and interact in the soil to help farmers, gardeners and botanists understand their soil pollution problems. The independent variable, Antifreeze, will be compared with the control, water, to determine the amount of liquid absorbed in milliliters. The liquids, water and antifreeze, will be filtered through a three-centimeter soil core that is placed in a filter. The filter mechanism will be in a plastic cup that will collect any amount of liquid completely filtered through the soil. The amount of liquid in the cup will be subtracted from the original amount of liquid filtered to figure out how much of the liquid was absorbed. After experimentation, the data was analyzed through quantitative analysis as well as a Student T-Test. The mean of the amount of water absorbed was 15.43 milliliters with a standard deviation of 2.92 where as the mean for the amount of antifreeze absorbed was 7.6 milliliters with a standard deviation of 1.58. The p-value was lower than 0.05 meaning that the null hypothesis was rejected and that the alternative was accepted.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Testing for the Bioaccumulation of Strontium 90 in the Mollusks of Lake Anna

Robert Tagliaferri

The North Anna Nuclear Power Facility has been running for 30 years. Previous studies have used clams as bioindicators to detect low level nuclear waste around similar nuclear power states in the United States. The purpose of this research is to determine whether the North Anna Facility is leaking any nuclear waste, specifically strontium-90, which could cause detrimental effects on the surrounding environment and populations from radiation exposure. Corbicula fluminea (Asian clams) were collected from four distinct areas in Lake Anna. The clams were reduced to ash and the solid ash was reduced into a solution via Hach acid digestion. This solution was spectrophotometrically analyzed for strontium content using a colorometric assay using xylenol orange, which selectively bonds to strontium. Asian clams from Lake George in upstate New York were used as a control, as this lake is away from both nuclear power stations and prevailing winds that could carry nuclear material. Lake George is also environmentally similar in terms of water inflow and outflow, which may impact background radiation. Preliminary statistics on two collection sites using a two tailed t-Test show no significant difference between the four collection sites on Lake Anna (p=0.2494). The data was then pooled and compared to the control where there was also no statistically significant difference (p=0.9056). Data analysis continues on the other two Lake Anna collection sites. This project has found no significant difference in the strontium concentrations between the asian clams of Lake Anna and Lake George, demonstrating that there is no significant radioactive accumulation from the Lake Anna Power Plant.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Salinity on Submerged Aquatic Vegetation Growth and Dominance in the Chesapeake Bay Tidal Zone

Reilly Tifft

Salinity levels in the Chesapeake Bay have reportedly been rising, causing a decrease in the amount of SAV throughout the Bay. The independent variable was 15 trial sites. The dependent variables were the salinity level found and also the type of SAV found. The control groups were the average salinity and the dominant species of SAV in past years. The experiment was conducted by randomly choosing test sites and testing the salinity, followed by identifying the type of SAV that was living there. The alternative hypothesis was: if the salinity of tidal water from Great Falls to the Chesapeake Bay is related to the dominance and growth of a specific species of submerged aquatic vegetation, then the bay grass species that is the most dominant will be the most common in the salinity range of brackish water (0.5-30 dissolved salt parts per thousand). The result of the experiment was that the alternative hypothesis was not supported. The average salinity of the experimental group was 6.167 parts per thousand. This was well within a normal variance of the control groups mean (5.25 ppt). On the part of the SAV, the control mode was widgeon grass, but the experimental group had a mode of slender pondweed, with widgeon grass not even found during the experiment. Therefore, the independent variable did not affect the dependent variables. The biggest question raised by this experiment is what has caused the change in dominant SAV species because the salinity appears to not be the chief factor.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Wind Speed and Topography on the Travel of Pollution Plumes

Kendrick Umstattd

This project in its current form is the result of testing wind speeds of 10.78 km./hr., wind speeds of 49.57 km./hr., and different topographies’ effects on the travel of pollution. The initial goal was to determine under what conditions pollution would remain concentrated inside a city or small town, and under what conditions pollution would escape. The data measured could increase public awareness in the event of a building’s demolition, or the movement of pollution, by providing information about trends in pollution movement.

Legos were used to create model buildings, which were placed in a gridiron pattern for the city landscape, and around a four-way intersection for the small-town landscape. A homemade wind tunnel was utilized. Sand served as pollution. It was found that a higher percentage of pollution remained inside the city and small town under low wind conditions, whereas a higher percentage of pollution escaped the city and small town under high wind conditions, supporting initial hypotheses. The P-value showed a significant difference when pollution on the buildings was not counted. In the town, the pollution traveled along a more concentrated path than in the urban landscape, with the majority of pollution remaining concentrated along the path directly ahead of the pollution source.

The conclusions of this experiment are twofold. First, more pollution will escape an area under high wind conditions. Second, pollution will remain more concentrated along the main roads of a small town, while a city will create a more even distribution of pollution.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Housing Development Age on Soil Organic Carbon in Suburban Developments in Loudoun County, Virginia

Christopher Whimpenny

Due to global climate change caused by greenhouse gases, understanding the sources and storage locations of atmospheric carbon (C) is important, particularly the rate C is stored in the soils of newly developed areas because of the high rates at which grass and forest lands are being converted to urban and suburban use in the U.S. In large housing developments, during site preparation, the natural vegetation and top soils are removed, resulting in soils with little Soil Organic Carbon (SOC). This experiment determined how the time since a development was constructed affects the SOC levels as determined by Loss-on-Ignition. It was hypothesized that the more time since construction, the higher the SOC levels would be. Samples were taken from developments of various ages (0-14yrs) and from nearby woods. Developments aged 3-14 years showed a statistically significant increase in SOC with the increasing age of the development when compared to the control, 0 age development, and when compared to each other (p>0.05). A significant increase in SOC was observed between the developments of various ages. The t-test showed statistically significant differences in the SOC levels between control (0 years) and all the experimental groups (p<0.05).

The original hypothesis, the amount of C in the soil will increase the older the development is, was supported by the data. The mean SOC of a housing development showed a significant increase as the age of the developments

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
## Mathematical Sciences (1300)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1301G11</td>
<td>Burns, Rachel</td>
<td>Mathematically Modeling the Efficacy of Pertuzumab and Trastuzumab-dm1 when Used in Conjunction against HER2-Positive Breast Cancer</td>
</tr>
<tr>
<td>1302C10</td>
<td>Meredith, Krysta</td>
<td>The Prevalence of Natural Fractals and How Well They Can Be Modeled With a Computer</td>
</tr>
<tr>
<td>1303D12</td>
<td>Nueslein, Brianne</td>
<td>The Foraging Behavior of the Zophobas morio Larvae as a Mobility Model of the Levy Walk</td>
</tr>
<tr>
<td>1304C10</td>
<td>Zeman, Brock</td>
<td>Using readability formulas to compare the average grade levels of popular publications throughout decades to determine fluctuations in readability ease over time</td>
</tr>
<tr>
<td>1305L12</td>
<td>Zhang, Jeffrey</td>
<td>Modeling the Effectiveness of Acetic Acid or Hydrated Lime as Treatment Methods for Invasive Didemnum vexillum in Puget Sound</td>
</tr>
</tbody>
</table>
Page intentionally left blank.
Mathematically Modeling the Efficacy of Pertuzumab and Trastuzumab-dm1 when Used in Conjunction against HER2-Positive Breast Cancer

Rachel Burns

HER2-positive breast cancer is characterized by an overexpression of HER2, a growth receptor protein, on the surface of the cell, which increases the rate of cell growth and replication. Pertuzumab is a chemical which targets and binds to HER2 proteins, resulting in an inhibition of cell signaling, eventually leading to the death of the cell. Trastuzumab emtansine (T-DM1) is an antibody-drug conjugate that not only binds to the HER2 protein and inhibits signaling, but also injects emtansine, a derivative of chemotherapeutic agent maytansine, into the cell following the bonding of the compound to the HER2 protein, thus killing the cell.

Mathematical modeling of breast cancer tumors in response to various treatment regimens of T-DM1 and pertuzumab can provide a cost effective method of analyzing dosing regimens by decreasing the number of clinical trials necessary. This modeling is achieved through a manipulation of the Koch Tumor Growth model involving a set of dynamic parameters which will allow the effect of different dosing strategies on the tumor to be observed as these parameters are altered.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Prevalence of Natural Fractals and How Well They Can Be Modeled With a Computer

Krysta Meredith

The prevalence of fractal patterns in plants are accounted for by comparing their patterns with computer-generated fractal patterns made to model the original specimen. Many members of each species were collected and observed, and then average drawings of their patterns were created. A computer program was used to create fractal patterns that resembled the drawings of each species. The veins in each order, or level of branching were counted in both the drawings and the generated picture, and a difference between the two was calculated, and later totaled for each species. The main objective of this experiment was, of twelve species of plants commonly found in Northern Virginia, to show which was the most fractal. The original hypothesis was that Northern White Cedar would have the least differing number of veins, being most able to be modeled by a computer, and therefore being the most fractal. Experimentation has shown otherwise, and of the species tested, Black Oak is shown to have the least differing number of veins with a difference of 26, while Northern White Cedar has a difference of 93. Experimentation has brought forth other data, such as when one ascends in orders, there is a larger difference of veins. Also, species with a large number of veins showed a larger difference between the drawing and generated pattern.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Foraging Behavior of the Zophobas morio Larvae as a Mobility Model of the Levy Walk

Brianne Nueslein

The Levy Walk is a heavy-tailed power-law distribution that can be used as a mathematical model of animal foraging. In nature, this type of foraging is characterized by a series of short steps followed by a small series of long steps. The purpose of this research was to determine whether data collected from mealworm (Zophobas morio) foraging behavior could be used as a model of the Levy Walk distribution in such a neurologically simple organism. Every thirty seconds, pictures of the worms’ movement inside a terrarium were taken until the worm found food. Images were then analyzed to determine the frequency of step size intervals, which were combined into an aggregated data set used for the final statistical analysis. Statistical analysis was conducted and the null hypothesis, that the worms’ movement would not model a Levy Walk, was rejected. After obtaining values for the Levy Walk equation

\[ l_{\text{min}} = \left( -e^{b/(a+1)} \right)^{-1/(a+1)} \]

the minimum step size (lmin) was calculated and compared to the estimate used when binning the data for frequency values. The results showed that an lmin estimate of 1.0 very closely modeled a Levy Walk distribution. Further research would entail determining the effects of the environment on the foraging behavior of the mealworms to see if the Levy Walk is disrupted. This optimal foraging pattern, while not shown in higher organisms such as humans, may provide information on how to optimize feeding regimens for endangered species to ensure their survival.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Using readability formulas to compare the average grade levels of popular publications throughout decades to determine fluctuations in readability ease over time

Brock Zeman

Readability tests are indicators that measure how easy a document can be read and understood. Simple, but very often ignored, readability statistics cannot only provide information about the level of difficulty of the readability of particular documents but also can increase an evaluator's credibility. Books are a part of our everyday lives. Despite the commonality of publications, they can be of variable difficulty. The aim is to find whether or not books are becoming more challenging by using three different readability indexes: Flesch-Kincaid, Gunning's Fog and Coleman-Liau readability scores. Ten popular books (as according to Publisher's Weekly) from nine sequential decades (1920s to the 2000s) were put through the three readability tests to find the average readability of each decade. Readability statistics were calculated for each book and then an average for each decade was found. The three readability indexes each had drops in every decade (0.55, 0.58 and 0.23 less, respectively). The overall drop in readability was about five grade levels for the Flesch-Kincaid readability score and about three grade levels for the other two. The purpose of this experiment is to find whether or not books are becoming easier to read plus to find differences between readability scores.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Modeling the Effectiveness of Acetic Acid or Hydrated Lime as Treatment Methods for Invasive Didemnum vexillum in Puget Sound

Jeffrey Zhang

The invasive carpet tunicate Didemnum vexillum has established colonies in the Puget Sound area of Washington State, causing millions of dollars in damage as they spread. The current method of eradicating colonies is both expensive and labor intensive, involving scuba divers manually diving and removing the individual colonies. For this reason, better treatment methods are needed. However, little is known about this creature, so a theoretical population model was created for D. vexillum to analyze the potential effects of acetic acid or hydrated lime, which show promise as treatments in laboratories. A differential equation population model was created from a model for a similar species of tunicate, and was made more dynamic and accurate by incorporating additional partial differential equations for various aspects of the environment such as temperature, salinity, and reproductive seasonality. This system of differential equations was then converted to parameters and incorporated into a finite difference equation. Sliders were created for each differential equation, so that they could be varied, allowing for simulation of a wide range of environments and treatment methods. Contrary to past literature, this model suggests that taking advantage of the reproductive seasonality of D. vexillum would allow for complete collapse of the colony without needing complete mortality of the population.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
# Medicine & Health Sciences (1400)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1401W12</td>
<td>Alam, Ayaan Armstrong, Lara</td>
<td>Investigating the Long-term Effects of Acetaminophen Use on Alveolar Epithelial Cell Gene Expression and Morphology</td>
</tr>
<tr>
<td>1402T12</td>
<td>Bowen, Gentry</td>
<td>The Effect of Heart Rate on Reaction Time</td>
</tr>
<tr>
<td>1403D12</td>
<td>Chugg, Gillian Grecco, Emma</td>
<td>Does Vitamin B6 Alleviate Chemotherapy Effects</td>
</tr>
<tr>
<td>1404D12</td>
<td>Fleming, Lia</td>
<td>Energy Conservation via Pose Running Technique: A Therapeutic Exercise Strategy for Musculoskeletal Disorders</td>
</tr>
<tr>
<td>1405D12</td>
<td>Goldbeck, Lauren</td>
<td>The Relationship Between Retinol and Stem Cell Differentiation after Embryonic Retinal Damage of Danio rerio (Zebrafish)</td>
</tr>
<tr>
<td>1406C09</td>
<td>Hinchberger, Victoria</td>
<td>The Effect of Ambient Temperature and/or Precipitation on the Total Number of Human Cases of W.N.V. (West Nile Virus)</td>
</tr>
<tr>
<td>1407P09</td>
<td>Mery, Nicole Olsen, Aubrey</td>
<td>The Effects of Ethanol on the Development of Brine Shrimp</td>
</tr>
<tr>
<td>1408J10</td>
<td>Olson, Savannah</td>
<td>The Effect of Colorblindness on Afterimages</td>
</tr>
<tr>
<td>1409C12</td>
<td>Oswari, Alexander</td>
<td>The effect of Clove oil on Amyotrophic Lateral Sclerosis</td>
</tr>
<tr>
<td>1410C09</td>
<td>Paek, Katrina</td>
<td>The Effect of Various Types of Acids on Tooth Enamels</td>
</tr>
<tr>
<td>1411J09</td>
<td>Veligatla, Vasudha</td>
<td>The Correlation Between Blood Type and Death Rate Due to Leukemia</td>
</tr>
<tr>
<td>1412D12</td>
<td>Wenzel, Alyssa</td>
<td>Analysis of Isoniazid as a DNA Methylation Inhibitor Inducing Autoimmunity</td>
</tr>
<tr>
<td>1413S10</td>
<td>Yerramasu, Padmini</td>
<td>The Effect of Sanguinarine in Chemoprotection and in Reducing the UV Exposure Mediated DNA Damage by Eliminating the Mutated Cells.</td>
</tr>
<tr>
<td>1414C10</td>
<td>Zartman, Bradley</td>
<td>Eating For Peak Performance</td>
</tr>
</tbody>
</table>
Page intentionally left blank.
Investigating the Long-term Effects of Acetaminophen Use on Alveolar Epithelial Cell Gene Expression and Morphology

Ayaan Alam
Lara Armstrong

Acetaminophen, marketed primarily under the name Tylenol, is a commonly-used over-the-counter analgesic and antipyretic often used in the treatment of chronic pain. Unfortunately, few investigations have focused on the potential long-term effects of acetaminophen use. It is hypothesized that the free radicals generated by acetaminophen stimulate the proliferation of fibroblasts in the lungs by dysregulating interactions between epithelial and mesenchymal cells. The resulting transition of epithelial to fibroblast cells, a process known as EMT, typifies idiopathic pulmonary fibrosis (IPF). IPF is a progressive, fatal pulmonary disease for which there are no effective or approved drug therapies (Horowitz & Thannickal, 2008). By culturing alveolar epithelial cells in 2 mM acetaminophen media, a concentration equivalent to the suggested therapeutic dosage, the researchers hope to find changes in the expression of smooth muscle actin and collagen, as well as morphologic changes indicative of fibroblastic activity. Currently, phosphatase assays have shown that acetaminophen concentrations higher than 2 mM have a statistically significant difference in growth. Although alveolar epithelial cells grown in 7 mM acetaminophen media for over a week did indeed exhibit slower growth, no gross changes in morphology appeared. Further work, including qPCR, will allow the researchers to definitively comment on any shift towards fibroblastic activity in alveolar epithelial cell gene expression, thus indicating the possible role of acetaminophen in the development of IPF after daily Tylenol use by victims of chronic pain.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Heart Rate on Reaction Time

Gentry Bowen

The purpose of this experiment is to test whether reaction time is affected by heart rate. If a person is walking around at night by themselves, their risk of being attacked is greatly increased. The attack would cause the heart rate of the person to dramatically increase. If the person's heart rate increases, will their reaction time increase and allow for more effective self defense? In this project, subjects (half male, half female and ranging from 9th to 12th grade) took the reaction test on the computer. They took one test with a normal heart rate (the control) and after each test they would increase their heart rate (independent variable) in order to see if their reaction time would be affected (dependent variable). After performing this experiment, the results showed that a person's heart rate does not affect their reaction time. The average reaction time for a normal heart rate is 322.25 milliseconds, 315.35 milliseconds for a medium heart rate (P < .05). For the medium-fast heart rate, the average reaction time was 319.42 milliseconds (P > .05) and with the fastest heart rate, the average reaction time is 263.69 milliseconds (P > .05). The null hypothesis is accepted, therefore heart rate does not affect reaction time. Even though blood is pumping faster throughout the body and there is more oxygen in the brain, it doesn't mean that the signals sent out of the brain are faster. When taking the reaction test on the computer, students could have gotten distracted or become nervous impacting their reaction speed. Further research could explore ways in order to make the signals from the brain faster or if there is any way not found yet in order to increase reaction time.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Does Vitamin B6 Alleviate Chemotherapy Effects

Gillian Chugg
Emma Grecco

The objective of this research is to see if vitamin B6 can reduce the amount of oxaliplatin needed as a treatment for colorectal cancer. Oxaliplatin is a very toxic, commonly used chemotherapy drug that kills not only cancerous cells but healthy cells as well. The combination of vitamin B6 and oxaliplatin is intended to decrease concentration of oxaliplatin (and other toxic side effects) while maintaining the same level of cancer cell death. The effects of vitamin B6 and vitamin B6 with oxaliplatin on a colorectal cancer cell line (SW480) are investigated by treating cells with media containing varying concentrations of vitamin B6 (in the form of pyridoxal 5’ phosphate—PLP) and oxaliplatin. After optimization of PLP and oxaliplatin concentrations, data is collected by growing a control cell line, a vitamin B6 treated cell line, and a vitamin B6 and oxaliplatin treated cell line for 48 hours and completing a phosphatase assay to determine cell viability. To date, there are no clear growth trends between the optimization trials of oxaliplatin and PLP. Research is ongoing.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Energy Conservation via Pose Running Technique: A Therapeutic Exercise Strategy for Musculoskeletal Disorders

Lia Fleming

In the world of highly trained athletes, energy conservation, particularly when running, is of great importance. A new type of running called “pose running” was created in the 1970’s in order to conserve energy during sprinting. This running method shifts the center of gravity in order for the runner to use it to his/her advantage.

The purpose of this research was to determine whether pose running could be extended to increasing energy efficiency during movement. Subjects were taught the pose method of running and then for a period 4 weeks they alternated pose running and regular heal-to-toe methods. Distance covered as well as heart rate was noted at the end of each run.

Statistical analysis determined that while the pose technique tended to increase the amount of distance covered, in many cases, the average overall heart rate increased. This suggests that further research would entail using a different method of fitness measurement such as oxygen consumption which may be a better indicator of overall fitness. In addition, other factors may have contributed to these fluctuating heart rates such as environmental temperature variability. Regardless, the use of pose running allowed runners to extend the total distance subjects’ covered as opposed to the more common heal-to-toe method more commonly used. Hence the use of this novel method of locomotion warrants further exploration as a method of use for energy conservation in those who have musculoskeletal disorders that make movements energy intensive.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Relationship Between Retinol and Stem Cell Differentiation after Embryonic Retinal Damage of Danio rerio (Zebrafish)

Lauren Goldbeck

Glaucoma is an eye disease associated with increased intraocular pressure and an eventual deterioration in vision. Mutations in the gene CYP1B1, responsible for converting retinol into all-trans-retinol which is vital for embryological development, have been found to cause many forms of glaucoma. Mutations may inhibit production of retinoic acid or produce an excess of retinoic acid.

This research examined the effects of palmitate retinol on retinal stem cell differentiation speed in zebrafish larvae. Zebrafish larvae eyes were subjected to a .1% solution of propidium iodide to destroy retinal cells. Effects were studied by employment of a phototaxis array, where half of a Petri dish was kept in darkness and half was exposed to light. The number of larvae on each side was counted every five minutes and results indicated that propidium iodide affected the visual abilities of the fish. Larvae were then placed in differing concentrations of palmitate retinol: .3%, .5%, and .6%. The same phototaxis array was used to see any improvement in ocular abilities. Statistical analysis via a t-test determined that the null hypothesis, that palmitate retinol would have no effect on retinal stem cell differentiation, was refuted. Larvae placed in higher concentrations showed increased speed in retinal regeneration.

Further research would entail tracing the path of retinal cell destruction to regeneration with the use of electron microscopy. On a larger scale, research could be conducted on human patients suffering from degenerative eye disorders to determine whether continued exposure to retinol would improve vision.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Ambient Temperature and/or Precipitation on the Total Number of Human Cases of W.N.V. (West Nile Virus)

Victoria Hinchberger

The theme and purpose of this experiment was to investigate the rising epidemic of West Nile Virus, and if ambient temperature and/or precipitation has an effect on the spread of the disease. Data needed for the project was obtained from online sources. The years tested were 2002, 2003, and 2012. A regression test was performed for each group, with averages of the precipitation and temperature (I.V.) being used. The most important find was that two tests showed significance between the variables. The first hypothesis states that if a state’s ambient temperature is above 15 degrees Celsius during April through September, then the amount of W.N.V. cases will be higher than a state with an ambient temperature that is above 15 degrees Celsius. This was supported in 2012, with a P value of 0.03. The second hypothesis states that if a state’s annual rainfall is lower than eight centimeters during April through September, then the amount of W.N.V. cases will be higher than a state with an annual rainfall of more than eight centimeters. This was supported in 2003, with a P value of 0.002. These results mean there is some significance between the variables. One major source of error was that population size was not taken into account. Further studies for this project should group states into population size when tested.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effects of Ethanol on the Development of Brine Shrimp

Nicole Mery
Aubrey Olsen

The purpose of doing this experiment was to illustrate the effect of ethanol on the development of brine shrimp. In this experiment, different amounts of ethanol were put in petri dishes which contained brine shrimp eggs in a saline solution. The hypothesis, as the amount of ethanol increases, the number of unhatched eggs or dead brine shrimp will increase, was supported by the data. In the control groups (0% ethanol), 70-75% of the eggs hatched. Hatching in the other petri dishes was significantly less; 25% in the 1% ethanol and 0% in higher amount of ethanol. This study relates to the affect of alcohol on fetal development in other organisms, including humans. Further research could explore other drugs or substances that could affect the development of an organism.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Colorblindness on Afterimages

Savannah Olson

What if those that are colorblind did not use corrective lenses to see colors, and used their own eyes to determine the color instead? The purpose of the experiment is to determine if the afterimages for the colorblind are similar to afterimages for the non-colorblind. Results might suggest that this could lead to the colorblind using their afterimages to find the color of an object. The independent variable was the status of participants, colorblind (experimental) and non-colorblind (control). Each participant was asked to stare at colored circles for 30 seconds and then look at a white sheet of paper. The color they saw was recorded and was the dependent variable. The sample age range was 8-70.

It was found that the afterimages of the colorblind were different than the afterimages of the non-colorblind group ($X^2$ calculated $X^2 (1)=5.15923,p=0.0231, p$-type 1=0.05). Results suggest that the colorblind could not use afterimages to determine the true color of an object, and colorblindness influences afterimages. Overall, the data was significant, and the null hypothesis is rejected. The alternative hypothesis of if a colorblind person stares at colored circles, the color of the afterimage of those circles will be the same as the colors seen by the non-colorblind group was rejected, as the colorblind group generally saw different color afterimages than the non-colorblind group. A source of error is the size of testing groups because there were only 7 colorblind participants. Future research could explore how glasses affect the quality of afterimages.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of Clove oil on Amyotrophic Lateral Sclerosis

Alexander Oswari

Amyotrophic Lateral Sclerosis (ALS) is a deadly neurodegenerative disease that currently has no cure. One possible cause of this disease is a mutation in the SOD-1 gene that results in a defective enzyme and leads to the accumulation of free radicals. Antioxidants reduce the accumulation of free radicals, thus potentially alleviating the symptoms of ALS. Clove oil is an extract from an Asian spice that has been shown to have strong anti-oxidative properties. C. elegans were used as a model organism in this experiment because of their short lifespan and the availability of the FX776 strain that models ALS through a SOD-1 gene mutation and exhibits ALS symptoms via reduced locomotion ability. The purpose of this experiment was to see if Clove oil could have a positive effect on ALS modeled in C. elegans. The movements of FX776 worms treated with clove oil were compared to untreated worms using a trashing assay. In this assay, C. elegans had their life stages synchronized and were placed on plates with or without clove oil. After two days, they were transferred into M9 liquid medium, placed under a microscope and their motions were recorded in 30 second videos. Movements were quantified using video editing software. FX776 worms exposed to 10% clove oil thrashed significantly more than unexposed worms showing that clove oil could have a significant, positive effect on ALS.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Various Types of Acids on Tooth Enamels

Katrina Paek

Acid erosion damages tooth enamel and may gradually change shape and texture of the tooth. To help identify if acids cause damage to enamels, phosphoric and citric acid were used. Phosphoric acid products used were (Sprite®, Mountain Dew, and Coke®) and citric acid produces (apple juice and lemon juice) against the control group (H2O) on tooth enamels. Two tests were constructed containing a solution change, and no solution change. Twelve groups of three tooth enamels were used throughout the experiment. Using significant Anova Single Factor statistical test, differences were found between lemon juice and all other solutions. Soft drinks have potential health problems due to the acidity. The hypothesis was accepted since the P value was less than 0.05. Findings show that when the acid softens the tooth enamel, the enamel will be worn away more easily and become thinner over time. Further experiment could include the changing of solution daily versus weekly, increasing the number of independent variables, and increasing the sample size.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Correlation Between Blood Type and Death Rate Due to Leukemia

Vasudha Veligatla

This research was performed on people of all blood types and live in the first world countries to search a correlation between blood types O, A, B, AB and Leukemia death rate. The independent variable is the blood type; dependent variable is the death rate. The research has no control group. The data was collected for Leukemia death rate of the same countries. The null hypothesis; if the death rate due to Leukemia is studied, then it will show, that blood types have no impact on the deaths. Results from the data show that there is a correlation between blood types and Leukemia death rate. The t-test calculations for blood type and death rate were 2.38626E-13, 3.82983E-14, 0.000386 and 0.428709. It is shown that the null hypothesis is rejected.

The experimental hypothesis; if the death rate due to Leukemia is studied, then it will show that blood types have impacted the deaths, is accepted. Blood types O and A have a correlation with the death rate. However blood types B and AB do not have the correlation. A question to consider for further research is investigating if the same results would be found if research is performed with correlation between blood type and another disease.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Epigenetics is the study of environmental factors affecting the expression of genes without changing deoxyribonucleic acid (DNA) sequence via mutation. One epigenetic mechanism, DNA methylation, involves addition of methyl (CH3) groups to islands in DNA that contain a wealth of cytosines and guanines bases. Methylation is driven by DNA methyltransferases (DNMTs), a class of enzymes that add methyl groups to DNA. In normal mammalian cells, 70 to 80 percent of CG islands are methylated. The activity of some genes is suppressed by methylation while a lack of methylation leads to overexpression. Global hypomethylation has been linked to the development of diseases such as systemic lupus erythematosus (SLE). This autoimmune disease causes the body's immune system to attack any type of body cell and causes damage to organs and organ systems.

Since hypomethylation has been linked to drugs, the intent of this research was to determine whether isoniazid, a drug used in tuberculosis treatment, caused hypomethylation possibly leading to SLE. Jurkat E6.1 leukemic T-lymphocytes were exposed to isoniazid for 48 hours and DNMT activity was assayed via a plate reader. It was determined via statistical analysis that DNMT activity was reduced by 43 percent. As a result, DNA strands experienced hypomethylation instead of proper methylation thus inhibiting proper gene function. This prevents T-lymphocytes from attacking the body and could conceivably cause SLE.

Further research would entail the determination of CG island hypomethylation via PCR, electrophoresis, and gene sequencing to create specific genetic treatments tailored to individual patients.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Sanguinarine in Chemoprotection and in Reducing the UV Exposure Mediated DNA Damage by Eliminating the Mutated Cells.

Padmini Yerramasu

The experiment tested the effects of Sanguinarine, a bioactive compound extracted from Rhizome of Sanguinaria canadensis plant, in reducing UV exposure mediated DNA damage by increasing apoptotic response and eliminating mutated S. cerevisiae cells. The free radicals produced by ultraviolet radiation damage DNA resulting into skin cancer. S. cerevisiae cells can be used as a model system to explore the chemoprotection provided by chemo-protective agent Sanguinarine (IV) containing biocide that may reduce skin cancer development by eliminating the mutated cells.

The LD50 was determined by plating 200µL of cell suspension (10E3 Cells/mL) and irradiating with UVC for 5-50 seconds. The survival rate/CFU(DV) for “Set1 No Sanguinarine, No UV” was 128.3, “Set2 No Sanguinarine, UV” was 102 “Set3 Sanguinarine, No UV” was 130, “Set4 Sanguinarine, UV LD50 Experimental was 97.8. The ANOVA showed a statistically significant difference p<0.05 in survival rate between all four sets with least survival rate in set4 where Sanguinarine and UV were used together. T-test of set1 and 2 showed statistically significant difference (P<0.05) in CFU, and set 2 is showing lower average, indicating detrimental effects of UV light. T-test showed no statistically significant difference (P>0.05) in CFU in set1 and 3 showing Sanguinarine by itself does not kill in absence of UV exposure. T-test showed no significant difference (P>0.05) in CFU in set2 and set 4. Even though not significantly more, UV kills cells more in presence of Sanguinarine. However, the alternative hypothesis is refuted.

Further studies could compare the effect of topical application of Sanguinarine, prior to; or, after irradiation in higher animals. Its chemo-protective properties could be tested against other types of radiation. The antibacterial, antifungal, and antioxidant properties of Sanguinarine can also be tested.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Scientific studies have shown that what you eat can greatly affect your health and overall well-being. How do nutritional needs differ for athletes and what impact does a variance in these recommended levels have on their performance? At the initiation of this project, it was believed that the results would indicate that not only nutrition, but rest, hydration, frequency of meals, and several other key variables would have a notable impact on a runner's performance. Performance is defined as not only race times but also as the general feeling before, during, and after a workout as well as recovery and soreness. Data was collected on a weekly basis and consisted of all participants maintaining a weekly log of food and liquid intake, rest, workouts, and a measurement of how they felt before, during, and after a workout. This data was then combined and analyzed to determine any trends in the various measurements described above. One subject made dietary changes with the support of a nutritionist to determine the direct impact on performance when the key macronutrients were at optimal levels for an athlete. The results showed that when nutritional intake and other variables were at or above recommended levels for the subject, notable improvements in performance, well-being, and recovery were recognized. Each runner has a perfect mixture of these variables that vary based on age, weight, activity level, and many other variables, but the data supports that nutrition has a direct impact on an athlete's performance.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1501D10</td>
<td>Armstrong, Katherine</td>
<td>The Effect of Juglone on Micrococcus luteus</td>
</tr>
<tr>
<td>1502C10</td>
<td>Chavez, Maria</td>
<td>The Effects of Various Pesticides on the Quality of Potomac River Water and Quantity of Bacteria</td>
</tr>
<tr>
<td>1503D12</td>
<td>Day, Leah</td>
<td>The Effect of SlgA in Breast Milk on Escherichia coli Biofilm Formation</td>
</tr>
<tr>
<td>1504P10</td>
<td>Dorsey, Caroline</td>
<td>Effects of Mouthwash on Bacteria</td>
</tr>
<tr>
<td>1505D12</td>
<td>Frawley, Jenna</td>
<td>The Effect of Microenvironment Complexity on the Speed of Antibiotic Resistance Acquisition</td>
</tr>
<tr>
<td>1506V10</td>
<td>Haro, Alex Membreno Mejia, Jonatan</td>
<td>The Effect of Hand Sanitizer, Soap, and Water on Bacterial Growth</td>
</tr>
<tr>
<td>1507F10</td>
<td>Hoang, Chi</td>
<td>The effect of natural acne treatments on the zone of inhibition of Propionibacterium acnes.</td>
</tr>
<tr>
<td>1508W12</td>
<td>Keevey, Richard Nekic, Garrett</td>
<td>A Radical Spin on Water Filtration</td>
</tr>
<tr>
<td>1509W12</td>
<td>Konuri, Sahithi</td>
<td>Fungal Inhibition In Dermatophytosis Using Herbal Treatments</td>
</tr>
<tr>
<td>1510S12</td>
<td>Papazian, Alyssa Solhjou, Perri</td>
<td>The Efficacy of Allium sativum, Hydroxypropanoic Acid, Isothiocyanate, and Acetylsalicyclic Acid, Individually and in Synergy, on the Retardation of Biofilm Formation in Bacteria</td>
</tr>
<tr>
<td>1511D12</td>
<td>Reed, Taylor</td>
<td>The Effect of Temperature on the Presence of Bacteria in Pineapples</td>
</tr>
<tr>
<td>1512S10</td>
<td>Shufran, Christie</td>
<td>The Effect of Photoreactivation on Reverting Ultraviolet Induced DNA Damage by the Monomerization of Pyrimidine Dimers</td>
</tr>
<tr>
<td>1513S10</td>
<td>Varghese, Ann</td>
<td>The Effect of Oregon Grape Root and Amoxicillin, Alone and in Synergy, on Staphylococcus epidermidis</td>
</tr>
<tr>
<td>1514T10</td>
<td>Vasquez-Bolanos, Laura</td>
<td>The Effect of Different Fluoride Dentifrices on the Growth of Streptococcus mutans</td>
</tr>
</tbody>
</table>
Page intentionally left blank.
The Effect of Juglone on Micrococcus luteus

Does juglone, a natural toxin, have antibiotic properties against the bacteria Micrococcus luteus? The toxin juglone is also known as 5-hydroxy-1,4-naphthalenedione or 5-hydroxy1, 4-naphthoquinone and can be found in the Juglandaceae plant family, which includes the black walnut tree, or Juglans nigra (Dongmei et al., 2009). Its uses for a variety of other medicinal purposes (as an antiseptic, anti-cancerous, anti-fungal, and anti-parasitic agent) are still under debate (American Cancer Society 2011). This experiment is conducted in reference to the similar bacteria Brevibacterium linens, which was too difficult to obtain. The experiment explores the antibiotic properties of the toxin juglone and its potential use as an insect repellent with the mosquito-attracting Brevibacterium linens. After being extracted from black walnut hulls, juglone in two concentrations was tested, along with distilled water, with antibiotic sensitivity disks in agar plates. Initial testing showed zones of inhibition; however, the disks were contaminated with mold. The resulting zones of inhibition of 100% juglone averaged 28.786 mm, while the 50% solution was almost as effective with a mean diameter of 25.786 mm. Therefore, Micrococcus luteus is presumed to be susceptible to the toxin (CDC 2003). Further testing will be conducted with autoclaved juglone.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effects of Various Pesticides on the Quality of Potomac River Water and Quantity of Bacteria

Maria Chavez

There is limited data addressing the effects of pesticides on water. The purpose was to address the problem above and add to minimal data. If a pesticide dramatically alters one of the health factors, then bacteria in a Petri dish will suffer.

5/6 test tubes (1 as control) full of water, were mixed with various pesticides. A set of 5 Petri dishes was grown to serve as a control group to compare to. Another set of 5 was grown with samples of water mixed with their pesticides. The 2nd set was created to allow the other set to remain closed throughout. They were grown in an incubator for 2 days at 37°C. After the 2 days, health factors (nitrite, pH, etc) were measured.

High pH spikes, like the organic (7.8-->8.4), contributed to the toxicity of the pesticide; explaining decreased growth. For fungicide, there was a 0.5ppm (1mg/mL) increase in nitrite. A 0.5 increase did not harm bacteria (33% growth.) The insecticide stimulated growth, 42%. This supported the idea that insecticides mainly harm insects.

With a P-value of $3.3 \times 10^{-9}$, less than 5%, the data recorded supported the hypothesis; there was little chance the data occurred randomly, thus rejecting the null hypothesis. A method where in each trial pesticides were changed was used to demonstrate how each type of pesticide affected the quality of water and quantity of bacteria.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of SlgA in Breast Milk on Escherichia coli Biofilm Formation

Leah Day

Proper nutrients are instrumental in maintaining healthy gut flora in developing infants. The presence of the immunoglobulin slgA in breast milk helps maintain healthy digestive flora and infant health. When absent, developing digestive tracts are vulnerable to bacterial migration throughout the body which can lead to increased infant health problems.

The purpose of this research was to determine whether infant formula and cow’s milk were as successful as human breast milk in creating biofilms to sequester natural digestive gut flora preventing potential movement which could cause illness. Infant formula, cow whole milk, and human breast milk were inoculated with E. coli, incubated, plated and bacterial growth analyzed to determine bacterial sequestration via biofilm formation.

Statistical analysis via a t-test indicated that commercial infant formula had little effect on biofilm formation and bacterial sequestration as did the control. Both whole milk and human breast milk were successful in sequestering bacteria and forming biofilms around them. slgA may trigger film formation in E. coli, immobilizing them in the gut. A form of slgA present in cows’ milk interacts with bacteria found in cows’ guts. While infant digestive systems cannot break down casein in cow’s milk, slow implementation of exposure to whole milk in infants may be helpful for those mothers who have problems with lactation. If this inherent protein breakdown issue could be avoided in infants, the protective properties provided by immunoglobulin in cows’ milk would perhaps make a more suitable milk for infants whose mothers cannot produce milk.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Effects of Mouthwash on Bacteria

Caroline Dorsey

This experiment explores whether mouthwash companies have found active ingredients able to serve as a substitute of alcohol, while at the same time equaling alcohol's strength at killing bacteria. Ten paper disks were dipped into one mouthwash with alcohol (Listerine Ultra) and ten in the other without alcohol (Listerine Zero). Five disks of each group were placed into a culture dish filled with B. cereus and five disks into an E. coli culture dish (group 1). The same task was performed for the Listerine Zero (group 2). One disk (dipped in sterile water) was placed in each of the four dishes to serve as a control. The diameter of the clear rings left around each disk, as the result of killing the bacteria, were measured after 24 and 48 hours. The average diameter of the rings around Listerine Zero, after 48 hours on the B. cereus were 1.26 cm, and on the E. coli, 0.68 cm. Listerine Ultra rings on the B. cereus were 1.44 cm and on the E. coli, 0.96 cm. A t-test confirmed there was a statistical difference between the two groups for each of the bacteria tested. The hypothesis of the experiment was that if two mouthwashes were used to measure effectiveness at killing bacteria, then the mouthwash with alcohol would kill more bacteria. This was supported by the data collected. These results could alter what consumers look for when they are purchasing mouthwash.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Microenvironment Complexity on the Speed of Antibiotic Resistance Acquisition

Jenna Frawley

With the advent of antibiotic resistant strains of bacteria and decreased research in the production of new antibiotics, it has become imperative that currently available antibiotics are used effectively and at their full potency. Research is necessary to determine what contributes to resistance development in order to ensure the efficacy of current antibiotics.

The purpose of this research was to determine how microenvironment complexity may contribute to the speed of antibiotic resistance acquisition. Petri dishes were constructed with wells of varying patterns of complexity that served to create heterogeneous microenvironments for microbial growth. E. coli was introduced to the plate and timed to see how these microenvironments were exploited by the bacteria and how quickly bacteria became resistant to gentamicin.

Statistical analysis was conducted by interpreting the average rates of the E. coli movement via t-test. While there appeared to be no statistical difference in the speed of antibiotic resistance acquisition based on the complexity of the microenvironment, plates containing wells of travel with highest and lowest complexity showed that the average speed of bacterial antibiotic resistance acquisition in the control plate and day 2 plate were faster than on day 1. This is because the bacteria had developed resistance from day 1 and moved farther towards the antibiotic on day 2. Bacteria in Level 2 complexity plates did not fit this pattern. The human body is full of different microenvironments, which is why understanding the process of antibiotic resistance acquisition is so important.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Hand Sanitizer, Soap, and Water on Bacterial Growth

Alex Haro
Jonatan Membreno Mejia

Scientists study bacteria and try to figure out what the best way to kill bacteria is, which is what this experiment did. Three different germ killing agents were applied to Escherichia coli strain k-twelve to see which agent killed bacteria more efficiently. The independent variable was the type of cleaning agent, the dependent variable was the amount of bacterial growth, and the control group was the cotton swabs with water. To conduct this experiment, each of the three different germ killing agents were applied to twenty agar prepared Petri dishes, then they were placed in an incubator for three days. The data was analyzed using the ANOVA test. Based on the statistics, soap was the agent that killed most bacterial colonies with an average of 0.3 present colonies at the end of day 3. Hand sanitizer was next with an average of 1.05 present colonies. Water was last with an average of 3.4 present colonies. The null hypothesis was rejected but the alternative hypothesis, if Purell hand sanitizer is used, then fewer bacterial colonies will grow than after using hand soap or water, wasn’t accurate because the soap reduced the growth of bacteria more than the hand sanitizer. The soap, and hand sanitizer, both greatly reduced the growth of bacteria, when compared to the water. Scientists study germ killing agents because bacteria grows resistant to them. If a similar experiment were to be conducted again, it could be improved by using other germ killing agents, or other types of bacteria.
The effect of natural acne treatments on the zone of inhibition of Propionibacterium acnes.

Chi Hoang

Abstract
Natural remedies have been used in clinical medicine for thousands of years until the development of synthetic treatments. Over the years, many synthetic treatments have been used and are starting to become less effective (Cock, 2009). This experiment is designed to test for a natural acne treatment that is as effective as antibiotic treatments. By conducting this experiment, society will have another alternative to clearing acne without overusing antibiotics, which bacteria is increasing becoming resistant to.

Propionibacterium acnes was spread onto 9 blood agar plates using aseptic technique. Each plate was divided into quadrants. Each quadrant received a different treatment. The control was Tetracycline. Aloe Vera, Tea Tree Oil, and honey were blotted onto blank disks and placed onto the remaining quadrants. Zones of inhibition will be measured to determine the effectiveness of each treatment. Testing is still in progress. It is expected that the Aloe Vera will be as effective as Tetracycline, and more effective than Tea Tree Oil and honey.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
A Radical Spin on Water Filtration

Richard Keevey
Garrett Nekic

The purpose of this research is to determine if an electrospun mesh embedded with zinc oxide particles will filter contaminated water more effectively than an untreated mesh. Metal oxide nanoparticles, such as TiO2 and Fe2O3, have been shown to prevent biofouling through the creation of free radicals, which causes the lysing of cells. It is hypothesized that zinc oxide (ZnO) nanoparticles will have comparable antibiofouling characteristics. Nylon meshes embedded with ZnO nanoparticles were created and tested for their ability to prevent biofouling when used as a water filter. Preliminary results indicate that ZnO meshes are more effective than untreated meshes. SEM images show that the ZnO meshes had less biofouling accumulation than the untreated meshes. Additionally, the ZnO meshes blocked/killed more bacteria in water contaminated with Escherichia coli than untreated meshes. Further trials are in process.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Fungal Inhibition In Dermatophytosis Using Herbal Treatments

Sahithi Konuri

The purpose of the experiment was to see the effect of various herbal treatments on the inhibition of Candida albicans growth. 18 agar plates were prepared, 3 for each treatment, by spreading a diluted solution of Candida albicans and placing filter discs (5 per plate) soaked in the various treatments. The plates were incubated for 3 days. A phenomenon observed was that there was none or minimal growth in plates treated with tea tree oil and oregano oil. The mean diameters of the zones of the inhibition were: 0.051cm, 0.765cm, 0.644cm, 0.722cm, 0cm, and 0cm for barberry bark root extract, tea tree oil, aloe vera oil, oregano oil, Lotrimin (over-the-counter), and distilled water (control), respectively. A p-value of 0.001 in the ANOVA test shows that there are at least two groups that are statistically different from the control. A chi-square test yielded a p-value of 6.719X10^-18 rejecting the null hypothesis that there is no association between the treatment used and the growth of fungus. The hypothesis that if the over-the-counter topical treatment is used, then the fungal inhibition will be higher than when an herbal treatment is used was rejected. Tea tree oil and oregano oil effectively inhibited fungal growth in these experiments. The treatments were hydrophobic while the agar was hydrophilic so this might have led to poor absorption and diffusion of the treatments. If the experiment were to be continued, it should be focused on the effect of tea tree oil and oregano oil versus prescription strength treatments.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Efficacy of Allium sativum, Hydroxypropanoic Acid, Isothiocyanate, and Acetylsalicylic Acid, Individually and in Synergy, on the Retardation of Biofilm Formation in Bacteria

Alyssa Papazian
Perri Solhjou

Bacterial biofilm formation poses a threat to immunocompromised (specifically HIV/AIDS) and cystic fibrosis patients due to the bacteria’s ability to excrete extrapolymeric substances (EPS) on the cell membrane that prevents efficient antibiotic penetration. Biofilms are found on medical devices, industrial or potable water system piping, natural aquatic systems and living tissue, and not only resist treatment, but also act as a source of planktonic bacteria that can cause chronic relapsing infections due to periodic dispersal.

The purpose of the experiment was to determine the efficacy of antibacterial and quorum sensing inhibiting agents including Allium sativum, hydroxypropanoic acid, isothiocyanate, and acetylsalicylic acid, alone and in synergy, on the reduction of biofilm formation in the BSL 1 organisms of Enterobacter aerogenes, Pseudomonas fluorescens, and Micrococcus luteus.

The three organisms were grown to stationary phase in Luria broth. A 1:100 dilution of individual organism were added to every well of a 96-well microtiter plate. Each row of the plate was then assigned a treatment, either alone or in combination, giving 8 repeated trials per treatment. One row served as a control with bacterial culture alone with no treatment added. One control microtiter plate was prepared with the same treatments, but without bacteria. The plates were incubated for 48 hours at 37°C, then washed and stained with 1% crystal violet. The stain in each well was solubilized with acetic acid, and that solution was then analyzed in a spectrophotometer at 550 nm.

Results are pending.

Further research could determine the minimal inhibitory concentration necessary and the biochemical pathways involved in efficient prevention of bacterial biofilms.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Temperature on the Presence of Bacteria in Pineapples

Taylor Reed

The pineapple is the third most consumed fruit in the world; however, as a result of the presence of certain bacteria, they become unmarketable because of discolored fruit tissue. Although this discolored fruit is not harmful to consume, most people choose not to buy it because it looks spoiled. The purpose of this research was to determine at what temperature these bacteria are killed in order to make pineapples more marketable. Twenty-five pineapples were purchased from four different grocery stores and three different companies. Each was cut into five slices, all of which were swabbed and then plated. After 36 hours, the plates were checked and the fifteen plates exhibiting the most bacterial growth were identified. Five pineapple slices associated with each of those plates were then heated at the following temperatures: 120°F, 150°F, and 180°F. After all 15 pineapples were heated, samples were plated again and after 36 hours of incubation, bacterial growth was recorded. Statistical analysis revealed that the null hypothesis, that a certain temperature would have no effect on the bacterial growth, was refuted. At the highest temperature, more bacteria were killed, whereas at the lowest temperature seemed to allow the most bacterial growth. More specific research may determine which bacterial species are killed at high temperatures and which bacteria grow better at other temperatures.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Photoreactivation on Reverting Ultraviolet Induced DNA Damage by the Monomerization of Pyrimidine Dimers

Christie Shufran

Photoreactivation can revert oxidative damage of DNA caused by UV rays using the enzyme photolyase that can utilize visible light to monomerize thymine dimers before cell replication. Sunscreens protection is prophylactic. It does not protect cells once DNA is damaged. Photolyase can be an alternative to endogenous excision repair, for people with deficiency in excision repair enzymes (genetic disease xeroderma pigmentosum). The experiment compared the efficiency of photoreactivation to other mechanisms in repairing UV induced dimers and increasing survival rate in S. cerevisiae cells (HA2 strain) with functional photoreactivation system, sensitivity to UV-B and DNA repair enzymes similar to human cells. The LD50 that kills 50% of S. cerevisiae was determined (15 sec) by plating 200 µL of 10E3cells/mL and irradiating them with UVB in increments of 5 seconds. Set1 (unirradiated) had an average CFU 29.12, set2 (irradiated and incubated in dark) had an average CFU 20.93, set3 (irradiated and photoreactivation) was 20.31 The ANOVA showed statistically significant difference (p<0.05) between 3 sets. The T-test for set 1 and 2 showed a statistically significant difference (p<0.05) indicating cells were killed by UVB. The T-test between sets 2 and 3 showed no statistically significant difference (p>0.05), showing the cells were killed due to UVB and DNA damage was not reverted by photoreactivation to keep the cell alive thus, refuting the alternative hypothesis.

The combination of correct duration and intensity of photoreactivating light after UVB exposure can improve this experiment. Future experimentation can explore possibility to repair UVB induced DNA damage through topical application of photolyase derived from microorganisms, since humans are not known to have the ability to photoreactivate. The enzyme therapy can be combined with sunscreens, providing photoprotection and repair at the same time.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Oregon Grape Root and Amoxicillin, Alone and in Synergy, on Staphylococcus epidermidis

Ann Varghese

The extensive and improper use of antibiotics has caused bacteria to develop a resistance to common antibiotics. As a result, modern medicine must be able to keep up with the rapid rate at which bacteria develop resistance in order to treat infections. The use of plant derived products is being explored for treating infections caused by antibiotic resistant bacteria.

The experiment evaluated antibacterial potential of Oregon grape root and tested its synergetic effect on the antibacterial sensitivity of S. epidermidis. The independent variable was the type of antibacterial treatment Amoxicillin and Oregon grape root extract (IV), combined together to test synergy, and individually, were placed on sensitivity disks. Disks were then placed on Petri dishes inoculated with S. epidermidis. Zones of inhibition around each disk (DV) were measured 24 hours later.

The mean zones of inhibition for the experimental groups for Oregon grape root, amoxicillin, and in synergy were 1.78cm, 2.84cm and 3.04cm, respectively. An ANOVA test returned P less than 0.05, indicating that there was a statistically significant difference between the experimental groups. T-tests showed that the combination of Oregon grape root and amoxicillin had larger zones on inhibition indicating that the bacteria were killed at a lower concentration than either antibacterial agent alone (P less than 0.01). The null hypothesis was rejected and the alternative hypothesis was supported. The results showed a synergistic activity between these two agents.

Future research could test the effects of Oregon grape root on other bacteria or its synergy with other antibiotics.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Different Fluoride Dentifrices on the Growth of Streptococcus mutans

Laura Vasquez-Bolanos

Teeth are used every day in eating, or talking, and because of this the general public chooses to use dentifrice to take care of them. The purpose of this study is to determine if the types of fluoride active ingredients in dentifrices lowers the Streptococcus mutans count, the bacteria believed to cause the most common mouth disease of dental caries, or should the focus be placed elsewhere. Bacteria is grown and the dishes contain soaked discs of the independent variable groups of stannous fluoride, 0.454%, sodium fluoride, 0.243%, and sodium monofluorophosphate, 0.76%, meanwhile the control is left alone. The dependent variable is the measurement of the S. mutans colonies, by the method of zone of inhibition using millimeters squared. Both Stannous fluoride and sodium fluoride decreased S. mutans compared to the control (mean 39.27 mm² and 23.13 mm² versus 0). Stannous fluoride Decreased the greatest amount of S. mutans (39.27 mm²). The hypothesis is if there is a higher percentage of stannous fluoride, 0.454%, then there will be a decrease of Streptococcus mutans colonies compared to no dentifrice added was supported by the data (p<0.05). A source of error resulted in sodium monofluorophosphates failure to create a zone in the plates and the difficulty of growing the specific bacteria. Further research could explore the factors of the biofilm and saliva on dental caries. This research can be used to determine what solutions are most effective on decreasing the leading causes in caries to continue aiding the community in oral heal.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1601S12</td>
<td>Cheedella, Sourabh</td>
<td>Using Kerr-Newman Approximations to Retrodict Subatomic Particle Masses</td>
</tr>
<tr>
<td>1602S09</td>
<td>Curran, Tyler</td>
<td>The Effect of Temperature on the Flight of Baseballs</td>
</tr>
<tr>
<td>1603T12</td>
<td>Davidson, Andrew Jones, Austin</td>
<td>Is the Current Accepted Formula for the Force Behind an American Football Hit Accurate?</td>
</tr>
<tr>
<td>1604C09</td>
<td>Deason, Stephanie</td>
<td>Are Geodesic Domes Stronger than Gable Roofs?</td>
</tr>
<tr>
<td>1605C10</td>
<td>Gillis, Gabrielle</td>
<td>The Effect of Different Phone Models on the Amount of Radiation Emitted</td>
</tr>
<tr>
<td>1606S10</td>
<td>Haugh, Mary Mack, Andi</td>
<td>The Effect of Different Finger Placement during a Swimmer’s Stroke on the Drag Produced</td>
</tr>
<tr>
<td>1607D12</td>
<td>Hummer, Savannah</td>
<td>Efficiency Analysis of MPO Canopus in the Plotting and Analysis of Trans-Atlantic Exoplanet Survey Data</td>
</tr>
<tr>
<td>1608C10</td>
<td>McNabb, Christopher</td>
<td>The Correlation of Camera Type to Performance Achieved in Capturing Colors</td>
</tr>
<tr>
<td>1609F10</td>
<td>Menezes, Shannon</td>
<td>The effect of different metal conductors on the rate at which a magnetic force is generated.</td>
</tr>
<tr>
<td>1610W12</td>
<td>Rothacker, Eric</td>
<td>Determining Object Shape with Acoustic Location</td>
</tr>
<tr>
<td>1611S10</td>
<td>Smith, Sarah</td>
<td>The Relationship between Speed Walked on Energy Storage in a Circuit to Act as a Generating Device</td>
</tr>
<tr>
<td>1612L11</td>
<td>Turnbull, Seth</td>
<td>The Relationship Between the Total Watts in an EMF vs. the Amount of Watts Received by a Conduit of the EMF</td>
</tr>
</tbody>
</table>
Page intentionally left blank.
Using Kerr-Newman Approximations to Retrodict Subatomic Particle Masses

Sourabh Cheedella

The purpose of this investigation is to improve subatomic particle mass predictions using relationships derived from space-time metrics. Previous predictions using the Kerr metric did not account for electromagnetic contributions to mass. This investigation uses a derived equation from the Kerr-Newman metric that relates mass, angular momentum, and electromagnetic charge. The intent of this paper is to draw a closer link between the strong nuclear force and the gravitational force. Accordingly, this paper uses a scaled version of the gravitational force constant to predict particle masses. Previous models have made predictions with an average accuracy of 98.67%. With the Kerr-Newman model, preliminary results have produced an average accuracy of 99.998%. Baryons will be the primary subjects in this investigation. A new framework for the lepton family will be introduced to improve baryon mass predictions. Results in progress.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Temperature on the Flight of Baseballs

Tyler Curran

This experiment was set up to determine whether or not the temperature of a baseball can affect the distance the ball flies when hit with a baseball bat. For the experiment, a mechanism was built to hit the various baseballs. There were three sets of 15 baseballs each. Each group had baseballs at temperatures of either 100, 21 (Control, Room Temperature), or 0 degrees Celsius. The varying temperatures were used to determine whether or not they had an effect on the distance each ball flew. After the experiment was run, the results were analyzed using a T-test. The results showed that the mean distance the heated baseballs flew was over 100 inches farther than the average of the room temperature group, which had the next highest mean. Three separate T-tests were run, comparing each group to both of the others. In the end, two out of three T-tests had a P-value< 0.05, thus causing the null hypothesis to be rejected.

The conclusion drawn from the research was that the temperature of the baseballs does affect the distance they fly when hit with a baseball bat, thus the alternate hypothesis was supported. However, it appears that the temperature change must be rather drastic to make any real difference. Further research in this field could explore whether or not baseballs react the same way when pitched, as the balls were stationary in this experiment.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Is the Current Accepted Formula for the Force Behind an American Football Hit Accurate?

Andrew Davidson
Austin Jones

The book, “The Physics of Football”, written by Timothy Gay, has a formula in it used to measure the lbs/in² in a collision in American football. In this experiment, that formula was tested against a high-tech force meter. The independent variable is the mass and speed of the subject in the collision. The dependent variable is the force of the hit. There were three subjects at three different weight classes of 70 kg, 95 kg, and 130 kg. They were all males. Their 40 yard dash speeds were measured (needed for the formula) and had them hit a tackling dummy with the force meter hooked up to it. The means of the dependent variable for subject 1, 2, and 3 (our participants at three different weight levels) were respectively, 603.2082, 832.104, and 1022.66, all in pounds of force, as seen in tables 2, 4, and 6. The mean values for our control group were respectively, 605, 833, 1024, all in pounds of force, as seen in tables 2, 4, and 6. The experimental hypothesis, that if the formula used in Gay’s book is checked against known values of force that Gay’s formula will be proven accurate, was supported. This means that the formula is accurate. Our independent variable dramatically influenced the dependent variable. Further research could be exploring the validity of this formula in other sports.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Are Geodesic Domes Stronger than Gable Roofs?

Stephanie Deason

The problem that this science fair project addressed was whether geodesic domes were stronger than gable roofs and if the size affected how much weight that the structures could hold. The hypothesis stated that the smallest geodesic domes would hold more weight than all of the gable roofs. The purpose of this experiment was to determine how many grams that each structure could hold. Three sizes were tested along with the different structure types. The three sizes that were tested were 30cm, 20cm and 10cm diameter/length. Both the domes and gable roofs had 3 structures for each size to allow a more accurate testing. In total, there were 18 structures that were tested; 9 geodesic domes and 9 gable roofs. The geodesic domes and gable roofs were constructed out of bass wood and were created by triangles and connected with wood glue. The geodesic domes were constructed with interlock equilateral and isosceles triangles. The gable roofs were constructed by large isosceles triangles and rafters. The structures were tested by applying pressure with bricks and sand on top of the structures. The geodesic domes held 3 times more weight than the gable roofs and the smallest dome held the most weight out of all the structures. The results of the experiment supported the hypothesis.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
LCPS RSEF OFFICIAL ABSTRACT - 2013

The Effect of Different Phone Models on the Amount of Radiation Emitted

Gabrielle Gillis

Past research has suggested that overuse of cell phones is a health hazard. This experiment was conducted to determine which phone models emitted the greatest and least amount of radiation. Phone used were: Iphone 5, Iphone 4, Iphone 4s, Droid, Droid 2, Pantech Laser, and Pantech Impact. The amount of radiation emitted was measured. The experiment was performed by placing each phone into a faraday cage; which was designed to keep excess amounts of radiation from affecting the results. Each phone was called and texted 30 times. During every call or text a radiation reading was detected by a radiation leakage meter. The experimental tests showed that the Droid 2 emitted the most radiation per call with 0.032 mW/cm² and the Pantech Impact emitted the least amount of radiation with 0.085 mW/cm². For the text group, the Droid 2 and Droid emitted the most radiation with the same 0.36 mW/cm². The Pantech Impact had the least amount of radiation emitted with an average of 0.088 mW/cm². Therefore, the experimental hypothesis stating the Iphone 5 would emit the greatest radiation level for both call and text and the Pantech Impact would emit the least amount of energy for both call and text was rejected. A significant difference was found between all phone call radiation levels and phone text radiation levels using an ANOVA test. The experiment could be improved by testing the same type of phones in groups multiple times so a wider range of data is collected. Further experimentation could lead to an investigation in measuring the radiation emitted while talking on the phone for a long period of time. Also, it could lead to measuring the emitted radiation from music playing from a phone with headphones and without.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Different Finger Placement during a Swimmer’s Stroke on the Drag Produced

Mary Haugh
Andi Mack

The purpose of this experiment was to determine if the spacing of fingers during a swimmer’s stroke affects the drag produced. Every millisecond counts in swimming; therefore, finding the finger placement that produces the least amount of drag, and the most force to pull the hands through the water, is pivotal.

The experiment consisted of three hand molds with different finger spacing, 0cm, 1cm, and 2cm (IV). The hands were made using a casting and molding kit and attached to a pole with a force meter on one end. The hands were then pulled through the water and the force was measured in Newtons (DV). The depth of water and distance pulled were kept constant.

The mean force exerted for no finger spacing, 1cm, and 2 cm were 1.38 N, 1.42 N, and 1.84 N, respectively. An ANOVA and t-tests were performed which showed that there was a significant difference between the groups with the 2 cm finger spacing measuring the most force (P less than 0.05). The hypothesis, ‘The hand with medium finger spacing would exert the least amount of force,’ was not supported. More force was required to pull the 2cm finger spacing hand through the water indicating that this finger position would give the swimmer more pull in the water.

In further research could study the effect of finger placement with different strokes, such as butterfly, backstroke, and breaststroke.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Efficiency Analysis of MPO Canopus in the Plotting and Analysis of Trans-Atlantic Exoplanet Survey Data

Savannah Hummer

Astronomers across the world are interested in data collected by the Trans-Atlantic Exoplanet Survey (TrES). This survey uses three amateur telescopes set up at the Lowell Observatory, the Palomar Observatory and the Canary Islands to look for planets orbiting stars outside of the Milky Way Galaxy (aka “exoplanets”). To date, there have been five exoplanets discovered using TrES. The difficulty facing astronomers is the immense quantity of data files that require manual graphing and analysis.

The purpose of this research was to determine whether Minor Planetary Observer Canopus software (MPO Canopus) is suitable for efficient analysis of photometric data files collected from TrES. Using MPO Canopus, data was mined for stars whose data plots contained a curve resembling a sine wave which indicated potential exoplanet existence. The data was then imported into Microsoft Excel and exported as a Comma Delimited file for import into MPO Canopus so that the software could create graphical representations of the star data.

Minor Planetary Observer software proved to be suitable software for the purpose of graphing as it takes thousands of lines of data and produces plots of every point. These graphs, however, are requested by observatories so that professional astronomers can confirm the data representing the discovery of an Exoplanet. Creating the ability in the program for an amateur to do so would enhance our quest for understanding galaxies.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Correlation of Camera Type to Performance Achieved in Capturing Colors

Christopher McNabb

This experiment tests the performance of DSLR and Point-and-Shoot cameras. The independent variable in this experiment is the type of camera that is used to capture photos of a color spectrum diagram, the dependent variable being the amount of red, green, and blue that is picked up from each picture. The amount of each color was analyzed using the Colors Photo Analyzer. Each camera was mounted on a studio stand and used to take pictures of a color spectrum diagram, which was illuminated to 5600 Kelvin by Cool Lights™ 5600. The amount of each respective color was averaged for each camera, and used in the Chi-Square test, and produced p-values for each color. The p-values from each color refuted the hypothesis that DSLR cameras offer a better performance than Point-and-Shoot cameras, and supported the alternate hypothesis that the type of camera does not affect the performance that is given by a camera. The independent variable of camera type did not affect the dependent variable of camera performance. Further research should explore the performance given by cameras in low light situations, as the amount of colors retrieved the sensor differs based on the amount of light in the pictures.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of different metal conductors on the rate at which a magnetic force is generated.

Shannon Menezes

The verification of Lenz’s law can prove the usefulness of certain non-costly metal conductors in providing a faster and quicker efficient replacement for everyday metal objects such as car brakes. This experiment is designed to test the difference in time and magnetic field in the movement of a neodymium magnet between plastic, copper, and aluminum tubes with addition of iron filings. The rate magnetism is able to be generated greatly; however, for only for certain duration of time until the maximum magnetic field voltage is achieved. Throughout the experiment, the comparison of the metal tubes in the statistical analysis proved that aluminum without magnet, are the largest results of magnetic field voltage with the shortest time compared with copper and plastic. Similar experiments show that same properties found in metals create fields due to simple motion of electrons traveling through eddy currents, establishing a circulation of magnetic strength at each pole. This allows for the maximum fall time of each pole separation. The experiment was directed towards a surprising direction, as only time in seconds varied; however, magnetic field voltage was the same as initially expected for each metal group.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Determining Object Shape with Acoustic Location

Eric Rothacker

Although the use of RADAR for above ground detection of an object in a large open environment is well documented, its use in smaller enclosed areas is neither feasible nor cost effective. Acoustic location, the use of sound waves to detect objects, offers a possible alternative for military or civilian use. The purpose of this experiment was to determine whether an object was present and whether its shape could be differentiated from other objects. Using sound frequencies emitted towards an object from a frequency generator and received with an oscilloscope, the amplitude with the object absent and present as well as with four different solid shapes was analyzed.

After data clearly supported the presence of an object, a probability density chart was created from collected data to determine significant correlations between the specific objects tested. The data demonstrated clear specificity of different shapes with a level of certainty of over 99 percent for both the sphere and cube when compared to all other shapes. The data also supported the indication of similarly shaped objects with the trigonal pyramid and the cone showing a level of certainty of 89 percent when compared to each other and a certainty of over 99 percent when compared to any other shape.

While this experiment definitively supports active acoustic location to detect and differentiate objects, further research could involve a more portable product, cataloging object shapes, refining noise cancelation techniques to eradicate extraneous noise, and account for the Doppler effect to determine objects in motion.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Relationship between Speed Walked on Energy Storage in a Circuit to Act as a Generating Device

Sarah Smith

The purpose for this experiment was to create a piezoelectric circuit that would act as a portable generator to harness kinetic energy produced by walking to charge a battery. Further, to determine if walking speed affected the volts produced. A circuit was built with piezoelectric elements attached to create an electrical current. The circuit was placed on a shoe, and energy storage was measured with a multimeter after walking on a treadmill at speeds of 4.8 and 6.4 kilometers per hour.

The mean voltage stored for walking at 4.8 and 6.4 kph were 1.02 volts and 1.52 volts, respectively. The T test returned a P-value of less than 0.05 which indicates that there was a statistically significant difference in the volts stored between the experimental groups. Speed walked caused a change in the energy stored because walking faster caused the piezoelectric element to move faster, creating a strong electric current, allowing more energy to be stored. The null hypothesis states that the speed walked will not affect the volts stored. The null hypothesis was rejected. The alternative hypothesis was supported because walking at faster speeds enabled the circuit to store statistically significantly greater number of volts.

Future research could use this circuit design with a larger piezoelectric element or other method of creating an electrical current to store more energy and then experiment with effective ways of charging batteries.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Relationship Between the Total Watts in an EMF vs. the Amount of Watts Received by a Conduit of the EMF

Seth Turnbull

This project was designed to show a relationship between the total possible wattage within an electromagnetic field (EMF) against the number of watts received by a conduit of the EMF. Previous research shows that fluorescent tubes are conduits of an EMF at an average rate of 60Lm/1W. A formula was derived to use the observed bulb illumination values to find the wattage based on this year's data as well as the previous research.

The experiment consisted of a small solid state Tesla coil, a fluorescent tube, and a photodiode light sensor. After determining a constant, the coil lit the bulb at increasing distances. The light sensor collected 10,000 samples per second over the course of one second, giving an accurate average depiction of the bulb's Lux. Using an equipment specific formula written "P(W) = Ev(Lx) × A(M2) / ?(lm/W)" the amount of power in watts is correlated with the number of Lux. when other portions of the formula are constant.

The results supported the proposed exponential relationship between distance from the coil and wattage received.

The applications for this equation are vital to an ongoing, long-term goal. The formula can be structured to fit specific equipment and determine the amount of power that device will be able to receive at different distances. This can help determine, given a constant wattage, the strength an EMF would need to supply the minimal amount of power at the farthest distance and vice versa, thus contributing to the growth of wireless energy.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last Name, First Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1701B12</td>
<td>Andersen, Scott</td>
<td>Effects of Hydrogen Peroxide on Growth of Micro Greens</td>
</tr>
<tr>
<td>1702F12</td>
<td>Awasthi, Shriya</td>
<td>The Phytoremediation and Sequestration of Acetone in Spathiphyllum</td>
</tr>
<tr>
<td>1703S10</td>
<td>Betzner, Kristen</td>
<td>The Effect of Allelopathic Interactions Between Triticum aestivum (Wheat) and Lolium rigidum (Rye) Seedlings on Each Other During Germination and Growth</td>
</tr>
<tr>
<td>1704B09</td>
<td>Bhuiyan, Fariha</td>
<td>The Effect of Color Variation on Phototropism</td>
</tr>
<tr>
<td>1705V09</td>
<td>Breza, Katherine</td>
<td>The Effect of Different Types of Light on Plant Growth</td>
</tr>
<tr>
<td>1706H11</td>
<td>Byrne, James</td>
<td>Which Media Type Promotes The Fastest And Longest Root Growth Of Vitis (Grape)?</td>
</tr>
<tr>
<td>1707C12</td>
<td>Cain, Ami</td>
<td>A Study on Prolonging the Shelf Life of Cut Carnations by the Addition of Calcium Nitrate to the Conditioning Water</td>
</tr>
<tr>
<td>1708B10</td>
<td>Colbert, Daniel</td>
<td>The Effect of Different Concentrations of Bay Laurel Leaves' Juice on Killing Dandelions</td>
</tr>
<tr>
<td>1709T12</td>
<td>Cross, Olivia</td>
<td>The Effect of Salt Soil Stress on the Osmotic Pressure Of Plants</td>
</tr>
<tr>
<td>1710B10</td>
<td>Godman, Kelsey</td>
<td>The Effect of the Light Cycle on the Biomass of Bioluminescent Dinoflagellates</td>
</tr>
<tr>
<td>1711L12</td>
<td>Johnston, Lindsey</td>
<td>The Effect of the Light Cycle on the Biomass of Bioluminescent Dinoflagellates</td>
</tr>
<tr>
<td>1712D12</td>
<td>Kesick, Ariel</td>
<td>The Effect of Abscisic Acid on Phaseolus vulgaris (Kidney Beans) in Environmental Stress Conditions</td>
</tr>
<tr>
<td>1713V09</td>
<td>Malhani, Talina</td>
<td>The Effect of PH Level on the Growth of Phaseolus Lunatus</td>
</tr>
<tr>
<td></td>
<td>Shah, Sarah</td>
<td></td>
</tr>
<tr>
<td>1714V09</td>
<td>Mata-Chavez, Carlos</td>
<td>The Effect of Worms on the Growth of Lima Beans</td>
</tr>
<tr>
<td></td>
<td>Payne, Caitlin</td>
<td></td>
</tr>
<tr>
<td>1715L11</td>
<td>Miller, Alexandria</td>
<td>Comparing the Relationship of Aloe Leaf Length in Sand vs. Soilless Media</td>
</tr>
<tr>
<td></td>
<td>Talastas, Ashley</td>
<td></td>
</tr>
<tr>
<td>1716J09</td>
<td>Ojeda, Madison</td>
<td>The Effect of Non-Ionizing Radiation on the Germination and Early Growth of Phaseolus vulgaris</td>
</tr>
<tr>
<td>1717S10</td>
<td>Parkin, Emily</td>
<td>The Effect of Gibberellic Acid Solution on the number of Root Nodules in Trifolium repens (white clover)</td>
</tr>
<tr>
<td>1718F10</td>
<td>Ring, Samantha</td>
<td>The Effect of different pollutants on the growth and health of plants</td>
</tr>
<tr>
<td>1719D12</td>
<td>Royce, Trevor</td>
<td>Turf Grass Growth and Drought Resistance via Rhizobium Slurry Seed Processing</td>
</tr>
<tr>
<td>1720W12</td>
<td>Siddiqi, Maha</td>
<td>The Effect of Synthetic Auxins on the Rate of Flowering</td>
</tr>
<tr>
<td>1721D12</td>
<td>Verban, Jessica</td>
<td>Nitrogen Fixation Enhancement in Phaseolus acutifolius (Tepary Beans) During Drought Conditions via Rhizobial Slurry Processing</td>
</tr>
<tr>
<td>1722V10</td>
<td>Walser, Bryan</td>
<td>The Effects of Caffeine on the Growth of Epipremnum aureum (Scindapsus aureum) Plants</td>
</tr>
<tr>
<td>1723B09</td>
<td>Wong, Amanda</td>
<td>The Effect of the Concentration of Citric Acid on Sunflower Seed Growth</td>
</tr>
</tbody>
</table>
Page intentionally left blank.
LCPS RSEF OFFICIAL ABSTRACT - 2013

Effects of Hydrogen Peroxide on Growth of Micro Greens

Scott Andersen

The purpose of this experiment was to examine the effects of 3% hydrogen peroxide on spinach micro greens’ growth. The hypothesis of this experiment was if micro green spinach is watered with 3% hydrogen peroxide, then it will increase in harvested overall weight. Four micro green trays were evenly filled with a BMI commercial soil. There were two trays in the control group and two in the experimental group. The dependent variable was the micro greens’ harvested weight and the independent variable was the hydrogen peroxide given to the plants. After sowing equal quantities of seeds and treating the experimental group for twenty one days, plants were harvested, weighed, and results compared. At the end of the trial, it was found the micro green spinach that was not treated with the hydrogen peroxide weighted twenty nine point seven grams, while the experimental trays’ harvest weighted thirty four point one grams. The results supported the hypothesis. It would be beneficial to repeat this experiment, increasing the number of trials, and varying micro green varieties. The applications of this research could have an impact on micro green culture in industry production.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Phytoremediation, the uptake of toxic air pollutants by plants, is widely studied today and may be a promising solution for the removal of harmful indoor air pollutants, especially volatile organic compounds (VOCs). One plant which is known to have phytoremediation abilities is Spathiphyllum, which uptakes the VOC acetone. The purpose of this research was to determine whether Spathiphyllum mostly sequesters acetone in the roots, stems, or leaves after phytoremediation. This can help us understand how plants sequester toxic air pollutants post-absorption. The experimental Spathiphyllum plant was placed in a bell jar with acetone and allowed to uptake volatile acetone. Then, Soxhlet extraction was used to extract acetone from root, stem, and leaf samples taken from the plant. A Vernier Gas Chromatograph (G.C) and Logger Pro with Peak Integration Software were used to analyze and quantify the amount of acetone in each of the sample extracts. This procedure was repeated for a control Spathiphyllum plant not exposed to acetone starting from the Soxhlet extraction. As expected, no acetone was detected in the control Spathiphyllum. In the experimental Spathiphyllum, the leaf samples sequestered significantly more acetone than the stem or root samples. Therefore, in Spathiphyllum, uptake of acetone and likely other volatile pollutants can be optimized by increasing the leaf number and surface area.
The Effect of Allelopathic Interactions Between Triticum aestivum (Wheat) and Lolium rigidum (Rye) Seedlings on Each Other During Germination and Growth

Kristen Betzner

L. rigidum is common weed in wheat fields that can reduce grain harvest. In allelopathy, one organism stimulates or inhibits growth of another by releasing chemicals. This experiment investigated allelopathic interactions between T. aestivum (wheat) and L. rigidum (rye), using different sowing techniques (IV) and evaluated its efficiency in order to apply it for weed management or replacing phytototoxic herbicide. The seeds were sown in close proximity in equal-compartment agar, at the “same time” or “delayed” (7 days before or after the other). After 10 days, height (mm) (DV) and biomass (mg) (DV) were compared with control.

ANOVA and t-tests indicate no difference (p>0.05) in height or biomass of T. aestivum control and grown in close proximity of L. rigidum (T. aestivum was planted at the same time, before or after L. rigidum), indicating no inhibitory allelopathic effect of L rigidum on T. aestivum.

ANOVA and t-tests returned p>0.05, indicating no statistically significant difference in biomass of L.rigidum control and grown in close proximity of T. aestivum (L. rigidum planted at the same time, before or after T. aestivum). However, height of L.rigidum sown at the same time in close proximity of T. aestivum showed less height and all three groups of L.rigidum sown in close proximity of T. aestivum showed less biomass than control.

The alternative hypothesis was refuted, however T. aestivum inhibited the ability of L.rigidum to grow more than L. rigidum inhibited T. aestivum’s ability to grow. T. aestivum possibly possesses biochemicals that inhibited germination, growth of rye, although, they might have been released in minute quantities into agar and were probably degraded soon or became ineffective to significantly inhibit the growth of rye. Further studies can test other crops for allelopathic potential and sensitivity.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Color Variation on Phototropism
Fariha Bhuiyan

The purpose of this experiment was to determine whether specific wavelengths of light affected phototropism greater than others. This study can potentially positively impact crop growth and overall plant health. In this experiment the independent variable was the color, or wavelength, of visible light, the dependent variable was the curvature of the plants, and the control was the plants which were tested beneath unfiltered light. Plants were influenced to bend towards a light source and colored wraps were used to filter the light into hues of blue, yellow, and red. The original hypothesis, which stated, if the color of the light applied to the Vigna radiata plant has a wavelength of approximately 475 nanometers, then the Vigna radiata plant will display the greatest phototropism, was supported. Quantitative data was acquired and analyzed with t-tests, which showed that the null hypothesis was rejected and the results were significant. In descending order, the statistics showed that the blue group had the greatest average phototropism with a curvature of 1.02 radians, next the control with 1.12 radians, then the red group with 1.14 radians, and lastly, the yellow group with 1.33 radians. These results meant that the blue portion of visible light encouraged phototropism greater than the other colors in visible light. Errors may have occurred because of the differential health of the seedlings, and the usage of a protractor for the acquiring of angle measurements. Further research can explore how color variation affects the individual cells of plants leading to phototropism.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Different Types of Light on Plant Growth

Katherine Breza
Melissa Zepeda

The purpose of this experiment was to see if bean plants grew better or worse under different types of artificial light. Scarlet-runner bean plants were grown under halogen, incandescent, LED, and natural light. The type of light used was the independent variable. The control group was the plants grown under natural light. The dependent variable of the experiment was the height of the bean plants on the last day. Groups of plants were grown under each type of light for 4 weeks. The means for the plants grown under incandescent, halogen, LED, and natural light were 51.825 cm, 61.225 cm, 42.425 cm and 67.925 cm, respectively. When the data was tested using ANOVA, it was found that there was no artificial light that was significantly different from the others. However, the data for the plants grown under LED light was significantly different from natural light. The alternative hypothesis for this experiment was that “if a bean plant is grown under halogen light, then it will be taller than a bean plant grown under incandescent or LED light.” The hypothesis was not supported by the data, however there was a trend towards halogen plants being the tallest. The independent variable influenced the dependent variable resulting in different means with the data for the LED and natural lights being significantly different. Further research could explore what impact light has on germination or the rate of growth.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Which Media Type Promotes The Fastest And Longest Root Growth Of Vitis (Grape)?

James Byrne
Jonathan Gonzalez Araujo

Will grapevine cuttings root faster and produce longer roots in a sandy soil, soilless media with biofungicide (Bacillus subtilis) or a soilless media with mycorrhizae? The problem is that there are many media types that are known to be effective for growing grapevines but not for propagating them. Seyval Blanc (Seibel 5656) grapevine was used for this experiment, 15 cuttings per media. The independent variable of the experiment is the three type of soils used which are sandy loam, PRO-MIX BX BIOFUNGICIDE™, and PRO-MIX MYCORRHIZAE™. The dependent variable of the experiment is the root growth that was shown throughout the course of the experiment. The experiment controls were light (same light intensity measured in foot candles for the three groups), water amount, amount of soil used in all pots and the temperature. A heat mat was used for the experiment and its temperature was between 68 F and 70 F. Throughout the experiment PRO-MIX BX BIOFUNGICIDE™ was shown to be the most effective media for the propagation of the grapevine cuttings based on growth rate and root length. The conclusion does not support the hypothesis that sandy loam is the best media for propagation of grapevine cuttings. These results may be beneficial to the grape growing industry because it may mean that propagators could decrease rooting time in nursery production propagation.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
A Study on Prolonging the Shelf Life of Cut Carnations by the Addition of Calcium Nitrate to the Conditioning Water

Ami Cain

This project in its present form is the result of the need for prolonging the shelf life of cut conditioned carnations. It is hypothesized that cut carnations will last (stay fresher) longer with the addition of Ca (NO3)2 solution in the conditioning water. The experimental group of 25 cut carnations was conditioned in 10 gallons of a 200 ppm calcium nitrate solution. The control group of 25 cut carnations was conditioned in 10 gallons of tap water. Data was collected six times over a fourteen day trial period. The independent variable is the calcium nitrate. The dependent variable is the senescence (aging) of the carnation. Constants were the amount of the solution, temperature, light, length and size of flower, and the conditioning time. Data was measured in which both turgidity (pressure of H2O in calyx) and senescence (aging/ browning of petals) was collected. The results of the data indicated that the carnations stay fresher longer with the addition of calcium nitrate to the water. These results may benefit the floral industry as a possible method of improving cut flower shelf life. Further trials of this experiment testing increased numbers and varieties of cut flowers may be beneficial.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Different Concentrations of Bay Laurel Leaves' Juice on Killing Dandelions

Daniel Colbert

The purpose of this experiment in summary was to find a cheaper, more efficient way of killing Dandelions so your children are not near any hazardous materials when they are playing in the yard. The independent variable is the concentration of the Bay Leaves – 0%, 25%, 50%, 75%, and 100%. The dependent variable is the amount of cm to inches that the plants have wilted/shrunk, the controls are the pot sizes and the amount of liquid the plants receive daily. The procedures were to label spray bottles and pots with certain percentages and then begin to spray each plant that matches with each specific bottle, and after 12 days measure height and record observations. The most important things found in this project were that the most efficient way of killing Dandelions was to use 100% solution Bay leaves. The mean for my control group was 2.5cm, for 25% juice it was 3.7cm, 50% was 2.9cm, 75% was .45cm, and 100% was 2.3cm. The hypothesis was correct in that as the percentages went up the plant died more. For example this was proven in that in the first test of 25% plant went from 5cm to 3.7cm and the test with 100% went from 5.2cm to 2.3cm, this means that the more Bay leaf juice you have the quicker it will kill the plants. A area for error in the experiment was that there was only one trial and that will limit my statistics. The IV influenced the DV in that the IV killed the DV this compared to the control group in that they were all tested fairly by receiving the same amount of liquid, sunlight, soil, and pots.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Salt Soil Stress on the Osmotic Pressure Of Plants

Olivia Cross

The effect of salt on crops throughout the world can affect it dramatically. High levels on salt can result in the plant or crop to wither. This project serves to prove that salt soil stress affects the osmotic pressure of plants and crops. The control group in the project is the type of plant being used. It stays consistent because different plants may have higher tolerance for different levels of salt. The IV of the experiment is the amounts of salt added to the soil. There was 3 different amounts added (0.25 mg, 0.50 mg, 0.75 mg). The DV of the experiment was the amount of sunlight and water required to help the plant grow. The most important finding of the study was the validation that high levels of salt does decrease plant growth and can cause the plant to wither in an abnormal time frame: 10.43 mm for no salt, 8.05 mm for 0.25 mg salt, 6.30 mm for 0.50 mg, and 5.04 mm for 0.75 mg. In conclusion, the hypothesis ended up being correct, and the null hypothesis was rejected (p= 3.89418E-06, 8.33363E-10, 2.95831E-12). The higher the level of salt the less the plant grew, and the faster it would wither. Further research could include experimenting with different types of plants instead of using just one type of plant. Also, different types of salts could be used to experiment as well as different types of soil. Basic elements in the experiment can change the outcome of the experiment so it’s very crucial that the elements used are appropriate for the experiment so the results are clear and accurate.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of the Light Cycle on the Biomass of Bioluminescent Dinoflagellates

Kelsey Godman

This experiment tests the effect of the light cycle on the biomass of a population of Pyrocystis fusiformis, a species of bioluminescent dinoflagellate. For this experiment, the IV was the light cycle and the DV was the biomass. To start, a light fixture was constructed, by which the light cycle was controlled. Then, 75 10ml tubes of dinoflagellates in salt-water (in groups of five tubes) were set under a light set to switch every twelve hours, and 20 10ml tubes were set under a light set to switch every six hours. After fifty days, the dinoflagellates were poured into coffee filters to dry. Once dry, their biomass was measured. Data showed that the control group had a mean biomass of 0.025g per trial, and the variables had a mean biomass of 0.015g per trial. The t-test shows that P>0.05, and the alternative hypothesis, “if Pyrocystis fusiformis is exposed to six hours of daylight and six hours of darkness, as opposed to twelve hours, cycling for fifty days, then the biomass of the dinoflagellates will double compared to the control,” was rejected. Based on data collected in this experiment, P=0.84, and it is 16% probable that the alternative hypothesis is true. Therefore, the opposite hypothesis is supported, stating that shortening the light cycle has a negative effect on biomass. For future research, it would be interesting to discover the species’ bioluminescent response time (the time difference between when stress is added to the water and when the dinoflagellates luminesce).

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of 290nm Wavelength UV-B Radiation Exposure on Phaseolus vulgaris DNA

Lindsey Johnston

This experiment tested the effects of UV-B radiation exposure on Phaseolus vulgaris DNA. The purpose is to discover any environmental risks of UV-B exposure from the sun rays reaching the Earth's surface. First, a small punch of each plant leaf is placed into a separate tube. Add dilution buffer (50 µl) to each tube and then macerate to open up the cells. 1.3 µl of this liquid are then added to the 50 µl PCR reaction mix. These tubes are then placed into the thermal cycler. Mix up a 1% agarose gel and let set. Once the thermal cycler is complete, add 30 µl of dye, so the bands will be visible in the gel. Load the dyed liquid into the wells of the gel, place the gel into the electrophoresis chamber, and let run for about 45 minutes. Complete this process before the plants are exposed to the radiation and after 2 weeks of exposure. Two plants are exposed to direct UV-B light, two are exposed to indirect, yet close, light, and two more are exposed to very indirect light. After the final run, it was found that the plants migrated, on average, 26.723 mm farther down the gel when compared to the first run. Smaller fragments move farther down the gel than larger fragments due to the lower number of bases. The increased mobility, or smaller fragments, implies that there was an alteration of the nucleotide bases of the plants caused by UV-B exposure.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Abscisic Acid on Phaseolus vulgaris (Kidney Beans) in Environmental Stress Conditions

Ariel Kesick

Across the globe, drought affects agrarian economies as malnutrition and world hunger devastate countries. As a result, billions of dollars in agricultural production cause economies to plummet and millions of lives are lost due to starvation and environmental fluctuations.

The purpose of this research was to determine whether a spray could be created using abscisic acid to increase the life span of plants by affecting stomata closure and thus preventing water loss. Phaseolus vulgaris kidney bean plants were grown under drought and non-drought conditions to test the affects of abscisic acid on stomatal opening and closing. Abscisic acid was applied to plant leaves for 10 days and stomatal openings and closings noted.

Statistical analysis via a t-test indicated that the use of an abscisic acid spray had a significant effect on stomates, closing 83.5% of the stomata on drought-inflicted Phaseolus vulgaris leaves when compared to control plant leaves to which no abscisic acid was applied. The plants were able to conserve water and survive longer. This demonstrates that the spray could become a possible method by which to ensure survival of drought-inflicted crops. Further research would entail modifying the concentration of the abscisic acid spray to fit the needs of other crops. Elevation of the use of the product as a technological innovation to use in agrarian development to combat world hunger and benefit agricultural economies is also merited.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of PH Level on the Growth of Phaseolus Lunatus

Talina Malhani
Sarah Shah

This experiment was done to see if pH level of water matters when growing a lima bean plant. The independent variable was the different pH levels, the dependent variable was the height of the plant, and the control group was the plants given the water with a neutral pH. First the lima beans were germinated and the height of the bean was measured. Then the water was mixed with the acid and base depending on which experimental group they were in. The growth was then monitored for 15 days.

A significant finding was pH does affect growth. The mean for each group were as stated, pH of 5 (2.325 cm), pH of 7 (2.610 cm), and the pH of 9 (1.280 cm). Statistics showed that plants given water with a neutral pH grew the tallest. The null hypothesis was, plant growth does not vary depending on the pH level of water, it was rejected. The alternative hypothesis was accepted and proven by the means and p values.

The heights of the plants were different and the control group grew tallest due to the variables influencing each other. One problem was that sunlight was not evenly distributed to all plants. A question that arose was why the plant growth was not consistent. If this experiment were continued, something anticipated would be which plant stays alive longer and looks healthier.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Worms on the Growth of Lima Beans

Carlos Mata-Chavez
Caitlin Payne

Worms play a very key role in the environment. However, do worms actually have an immediate effect on plant life? In this experiment, two groups of Phaseolus limensis (lima beans) were used to attempt to answer this question, one group had Lumbricus terrestris (earthworms) in the soil, the other did not. The two groups of plants were left in a sunny area for twenty days. Each day, the plants were given 10ml of water and measured with a ruler. At the end of the twenty days, the data showed that the control group of plants, that without worms, in fact had grown higher than the group of plants with worms. The control group of plants without worms grew an average of .641cm, while the group of plants with worms grew an average of .115cm. The P value of this experiment was greater than 0.05 and the result of the t-test was 2.328093446. The alternative hypothesis was if worms are present in the growing of plants, then the plants will grow taller. The results of the statistical analysis do not support this hypothesis. The independent variable did affect the dependent variable, but in a negative way. One major source of error would be the death of the worms as the experiment went on. Would the plants have grown taller in a combination of fertilizer and worms?

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Comparing the Relationship of Aloe Leaf Length in Sand vs. Soilless Media

Alexandria Miller
Ashley Talastas

The experiment that was conducted was to see how well Aloe vera grows in sand as opposed to soilless media. The result of this experiment may show people which type of substrate Aloe vera grows better. The hypothesis for this experiment was if Aloe vera is propagated in sand vs. soilless media, then it will grow better (longer leaves) in sand. The method of propagation of Aloe vera was by division. Division is a technique used in propagating plants by taking offshoots from a stock plant. To reach this result, 24 offshoots of Aloe vera were taken; twelve were put in sand the other twelve put in soilless media. The sand and the soilless media that the Aloe vera will grow in will be the independent variables while the leaf length growth will be the dependent variable. To keep the experiment consistent, the offshoots will be kept under a constant environment. Other constants would include pots, amount of water given, and plant species. Through literature search data of leaf length recorded, most succulent and cacti have been shown to grow better in sand due to the fact they seem to thrive better in dessert environments. It was assumed that propagating Aloe vera in sand would have accelerated leaf growth compared to those propagated in soilless media. The results showed that plants in soilless media had a better growth rate than those in sand. The impact of this experiment is that propagators may now be able to know which substrate Aloe vera will grow better in. It may be beneficial to repeat this experiment, increase the trial numbers, and add and compare different types of substrates.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Non-Ionizing Radiation on the Germination and Early Growth of Phaseolus vulgaris

Madison Ojeda

Cell phone use is rapidly becoming more ubiquitous, however many people do not know about the potential harm cell phones may cause. Some potential dangers may include headaches, difficulties sleeping and possibly increased brain cancer risk.

The purpose of this experiment was to observe if non-ionizing (cell phone) radiation has any unwanted effects on plants. Two plant groups of 25 seeds were tested; the test group was placed on top of an RF generator which emitted 27 dBm, while the control group was placed on a table without radiation. The germination and height was measured and recorded for 14 days. The test group had an average germination of 6.16 days and mean plant height of 151.9 mm, while the control group had an average germination of 7.27 days and a mean plant height of 84.4 mm. The t-test was used with t = 3.02 on the growth rate of the plants.

The results from the experiment were statistically significant with p less than 0.05. The null hypothesis was rejected. The experimental hypothesis that if Phaseolus vulgaris seeds are exposed to non-ionizing radiation during its germination and early growth, then they will germinate slower and grow more irregular than seeds that are not exposed to non-ionizing radiation was supported. The seeds exposed to radiation germinated quicker and taller than the control group, but 24% of the test group had irregularly shaped leaves. For further research, would temperature changes alter the statistical significance of non-ionizing radiation on the germination and growth of the seeds?

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Gibberellic Acid Solution on the number of Root Nodules in Trifolium repens (white clover)

Emily Parkin

This experiment determined the effect of gibberellic acid solution, a growth hormone, on the number of (nitrogen providing) root nodules in Trifolium repens. Groups of clover plants were grown three different concentrations of gibberellic acid (IV); the number of root nodules after 4 weeks was measured using a compound light microscope (DV). Clover with 0 mL, 2 mL, and 4 mL of gibberellic acid had means of 0.4 root nodules, 1.26, and 3.06 root nodules per plant. ANOVA and T-tests were performed. T-tests showed a significant difference between the control and 4 mL gibberellic acid (P less than 0.05), but not between the control and 2 mL (P greater than 0.05). Gibberellic acid is a plant hormone that increases the rate of cell division. In this study, gibberellins may have increase the rate of cell division around nitrogen-fixing bacteria, resulting in more root nodules large enough to see with the light microscope. Further research could explore other effects of gibberellic acid solution, such as production of seeds in clover as well as other plants.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The effect of different pollutants on the growth and health of plants

Samantha Ring

Today, energy and fuel efficiency is a top priority for the science community. Recent developments such as biofuels have helped get a step closer to a more efficient fuel, and claim to be better for the environment. However, they can be just as harmful in a spill as standard fossil fuels. The goal of this experiment is to determine if there is a significant difference between the effects fossil fuels and biofuels have on vegetation. If festuca, commonly known as fescue sod, is exposed to either fossil fuels or biofuels, then there will be no significant difference in the height, color, moisture, and mold growth. This experiment, fescue grass was exposed to ethanol 85 as the biofuel and diesel as the fossil fuel. The control group was the plant that only received water and will not be exposed to any fuels. The height, moisture level, color, and mold growth was measured over time. After being exposed to a fuel for twelve days, the two tested patches had lower moisture levels, similar changes in color, shorter blades, and large growths of mold.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Turf Grass Growth and Drought Resistance via Rhizobium Slurry Seed Processing

Trevor Royce

Understanding how different Rhizobium species affect plant and turf grass resistance to drought and other environmental factors is of great value to the turf industry. These bacteria aid in nitrogen fixation. For turf fields that receive a great deal of wear and tear and use, methods that enhance grass growth is much needed.

This research employed the use of a Rhizobium medium used to coat tall fescue grass seeds which were then subjected to one of the following regimens of growth: excessive light of 16 hours, excessive wind for eight hours or a combination of the two. Control turf grew under normal environmental conditions. Statistical analysis via t-test indicated that the null hypothesis, that Rhizobium would have no effect on plant growth during drought, was accepted and refuted. Turf grass treated with Rhizobium grew better under heat conditions rather than other conditions. While there was no statistically significant difference between plant growth in the control and Rhizobium treatments, plants treated with Rhizobium appeared to tolerate heat better than windy conditions. Further research in enhancing drought and wind resistance in turf grasses is imperative particularly in arid areas. This would allow the growth of athletic turf fields in countries which may otherwise not be able to maintain field growth.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of Synthetic Auxins on the Rate of Flowering

Maha Siddiqi

Naphthalene Acetic Acid (NAA) and Indole-3-Butyric Acid (IBA) are synthetic auxins, which are manmade plant hormones that speed up growth. To measure the effect of NAA and IBA on the rate of flowering, both were applied to Wisconsin fast plants. Three groups containing fifteen plants each were set up; the first had NAA applied, the second had IBA applied, and the third had no synthetic auxin applied. Results showed that IBA increased the rate of flowering and NAA greatly decreased it. The means for the NAA, IBA, and control groups were 27.4, 20.1, and 21.2 days in which flowers bloomed. An ANOVA and t-tests was carried out to analyze the data. The null hypotheses were rejected because the p-values were less than the level of significance of 0.05. Since the null hypotheses were rejected, the data collected was statistically significant and the alternative hypothesis was accepted. The alternative hypothesis states: if the type of synthetic auxin is more powerful than the other, then the plants it is used on will bloom quicker. The longer the hydrocarbon side chain is of the synthetic auxin, the stronger it will be, which in this case is IBA. IBA had a positive effect on the rate of flowering while NAA had a negative effect when compared to the control group. A major source of error includes changing the location of the plants mid-experimentation. Further research includes creating synthetic auxins with varying hydrocarbon side-chains to see if in fact it affects the rate of flowering.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Nitrogen Fixation Enhancement in Phaseolus acutifolius (Tepary Beans) During Drought Conditions via Rhizobial Slurry Processing

Jessica Verban

Drought, a common cause of food shortage in the world, affects crops such as corn, wheat, and beans whose production has declined. Even upon irrigation, plants that experience drought conditions recover little. Intensive research is being conducted world-wide with the goal of ending malnutrition and hunger via the creation of new drought-resistant crops or methodology which provides plants with necessary nutrients. The purpose of this research was to determine whether the addition of specific Rhizobium species affects the growth of a Native American dietary staple, the tepary bean. Various species of Rhizobium were added to soil utilizing the slurry method, beans were grown under lights and growth measured. Under each Rhizobial condition, control groups grew under growth lights while drought condition were simulated by water restriction.

Statistical analysis via a t-test indicated that the null hypothesis, that there was no difference in growth regardless of the addition of Rhizobium, was refuted. Plant growth was enhanced with the additions of a combination treatment of Rhizobium leguminosarum vicesae, Rhizobium phaseoli, and Bradyrhizobium biovar sp. This supports the idea that the application of Rhizobium aids in the growth of tepary beans particularly under drought conditions. Plant growth under drought conditions was comparable to that of plants grown in control conditions. This indicates the exploration of this treatment as a method of enhancing crop production and plant longevity in drought stricken, arid areas.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effects of Caffeine on the Growth of Epipremnum aureum (Scindapsus aureum) Plants

Bryan Walser

Gardening enthusiasts aspire to promote plant growth. This experiment explored if varying amounts of caffeine added to tap water promote more growth in tendril length in Epipremnum aureum (Scindapsus aureum) plants (fast-growing, vascular house plants). Tendril growth is the dependent variable while 0%, 5%, 10% and 15% caffeine solutes were the independent variables. The four solute groups each contained thirteen plants. The control group plants were exposed to pure tap water while the other three groups included caffeine solutes. Plants were measured twice a week and watered weekly.

Using ANOVA testing, the control group’s standard deviation (8.01) is more than double the standard deviation of each experimental group indicating more dispersion within the control group. The mean growth rate of the control group (1.52cm) was visibly significant when compared to the mean growth of the 5%, 10% and 15% solute experimental groups (0.03cm, 0.08cm, and -0.06cm respectively).

The alternate hypothesis was if an Epipremnum aureum (Scindapsus aureum) is watered with 5%, 10%, and 15% caffeine solute, then it will have more tendril growth when compared to an Epipremnum aureum (Scindapsus aureum) watered with 100% public tap water, 0% caffeine solute. The p-value calculation of 0.718 (greater than the 0.05 threshold) indicates insufficient statistical evidence to support this hypothesis. Future research could be done to test lower levels of caffeine solute over extended periods of time and varied plant types.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of the Concentration of Citric Acid on Sunflower Seed Growth

Amanda Wong

The project focused on whether citric acid improves growth in sunflower seeds. The goal was to discover if citric acid could replace water in plant growth. The type of sunflower seed used was black oil sunflower seeds and were watered with natural citric acid, lime juice. Lime juice was chosen because of its average pH level of 2.4. A standard ruler measured the sunflower seeds growth in centimeters.

The experiment started by germinating thirty seeds and placing each in their own individual cup. There were three seeds for each trial, which resulted in the experimenter performing ten trials. The seed was watered with three different liquids, water or the control group and two different concentrations of citric acid. The growth of the plants height was measured twice a week.

According to the data, the concentration of the mixture of citric acid and water grew the best, supporting the hypothesis. When the null hypothesis was tested, it was discovered that the two concentrations of citric acid were significant while the water was discovered to be not significant. Although both concentrations of citric acid seemed to grow more than the plants watered with water, more studies could be done to extend the number of plants that respond the citric acid.

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
Page intentionally left blank.