# LCPS RSEF Categories

<table>
<thead>
<tr>
<th>Number</th>
<th>Category Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Animal Sciences</td>
</tr>
<tr>
<td>200</td>
<td>Behavioral &amp; Social Sciences</td>
</tr>
<tr>
<td>300</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>400</td>
<td>Biomedical &amp; Health Sciences</td>
</tr>
<tr>
<td>500</td>
<td>Biomedical Engineering</td>
</tr>
<tr>
<td>600</td>
<td>Cellular &amp; Molecular Biology</td>
</tr>
<tr>
<td>700</td>
<td>Chemistry</td>
</tr>
<tr>
<td>800</td>
<td>Computational Biology &amp; Bioinformatics</td>
</tr>
<tr>
<td>900</td>
<td>Earth &amp; Environmental Sciences</td>
</tr>
<tr>
<td>1000/1600</td>
<td>Embedded Systems; Mathematics</td>
</tr>
<tr>
<td>1100</td>
<td>Energy: Chemical</td>
</tr>
<tr>
<td>1200</td>
<td>Energy: Physical</td>
</tr>
<tr>
<td>1300</td>
<td>Engineering Mechanics</td>
</tr>
<tr>
<td>1400</td>
<td>Environmental Engineering</td>
</tr>
<tr>
<td>1500</td>
<td>Materials Science</td>
</tr>
<tr>
<td>1700</td>
<td>Microbiology</td>
</tr>
<tr>
<td>1800</td>
<td>Physics &amp; Astronomy</td>
</tr>
<tr>
<td>1900</td>
<td>Plant Sciences</td>
</tr>
<tr>
<td>2000</td>
<td>Robotics &amp; Intelligent Machines</td>
</tr>
<tr>
<td>2100</td>
<td>Systems Software</td>
</tr>
<tr>
<td>2200</td>
<td>Translational Medical Science</td>
</tr>
</tbody>
</table>

For detailed category descriptions visit the ISEF website at: [http://www.societyforscience.org/isef/project_categories](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. For example, project **1303T10** is the third project in Engineering Mechanics. The letters, T or X, in the project number indicate whether a project is a Team (T) project or an Individual (X) project.
<table>
<thead>
<tr>
<th>Last, First Name</th>
<th>Project No.</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abad, Gino</td>
<td>211T12</td>
<td>The Effect of Blue Light Exposure Versus Warm Light (&quot;Night Shift&quot;) Exposure on the Quality of Sleep in Persons Aged 16 Years and Older</td>
</tr>
<tr>
<td>Acosta, Elsa</td>
<td>401X12</td>
<td>Development of a DNA Test for Sarcocystis neurona</td>
</tr>
<tr>
<td>Adapa, Keerthana</td>
<td>2101X12</td>
<td>Testing the Accuracy of a Machine Learning Text Classifier</td>
</tr>
<tr>
<td>Ahmad, Ibrahim</td>
<td>2102X12</td>
<td>The Effects of Different Machine Learning Algorithms on the Accuracy of a Diabetes Classifier</td>
</tr>
<tr>
<td>Ahmad, Zohaa</td>
<td>402X12</td>
<td>Establishing the Effect of Turmeric on the Memory of C. elegans using a Chemotaxis Assay</td>
</tr>
<tr>
<td>Akalwadi, Siddharth</td>
<td>1101X12</td>
<td>The Effect of Pressure on the Efficiency of an Algae Photobioreactor</td>
</tr>
<tr>
<td>Akula, Nikhila</td>
<td>1701T10</td>
<td>The Effects of Biofilms on Bacterial Cultures</td>
</tr>
<tr>
<td>Alcantara, Lea</td>
<td>601X12</td>
<td>Kale and Lettuce Protoplast Fusion</td>
</tr>
<tr>
<td>Ali, Syed</td>
<td>403X12</td>
<td>The Effect of Various Computer Tasks on Human Eyes’ Blink Rate</td>
</tr>
<tr>
<td>Allen, Hannah</td>
<td>201X12</td>
<td>The Correlation between Individual PERMA Scores and Increased Gratitude Expression</td>
</tr>
<tr>
<td>Amaya Roca, Kevin</td>
<td>404T12</td>
<td>Using Direct Current Stimulation to Treat Parkinson’s Disease at Different Stages using C. elegans as a Model Organism</td>
</tr>
<tr>
<td>Amin, Nikita</td>
<td>202T11</td>
<td>Investigating the Effects of Magnesium Supplementation on ADHD Using Drosophila melanogaster</td>
</tr>
<tr>
<td>Angel, Jeremy</td>
<td>1602T11</td>
<td>Predicting Seizures Using Non-Spiking and Spiking Artificial Neural Networks in Sequence</td>
</tr>
<tr>
<td>Anumukonda, Sujit</td>
<td>405X12</td>
<td>The Inhibition of Mold Growth on Bread</td>
</tr>
<tr>
<td>Arana, Chloe</td>
<td>1501X12</td>
<td>Engineering Silicone Polymers with an Olive Oil Solvent to Enhance Tensile Strength</td>
</tr>
<tr>
<td>Armstrong, Allison</td>
<td>1510T11</td>
<td>The Effect of Different Powders on Durability of Plastic Spoon Substitute</td>
</tr>
<tr>
<td>Assana, Hisham</td>
<td>406T12</td>
<td>The Epigenetic Effects Of Low-Level Environmental Hydrogen Peroxide in Drosophila</td>
</tr>
<tr>
<td>Avasarala, Priyanka</td>
<td>101T12</td>
<td>The Effect of Dipeptide L-Carnosine VS Vitamin C on the Regrowth of Cells in Planarian</td>
</tr>
<tr>
<td>Awasthi, Neha</td>
<td>102X12</td>
<td>The Effect of Adding Dietary Algae on the Amount of Methane Released By Bos taurus as Tested in an Artificial Rumen</td>
</tr>
<tr>
<td>Azem, Noor</td>
<td>1502X12</td>
<td>Creation of Self-Healing Concrete via Bacillus sphaericus formation of Limestone</td>
</tr>
<tr>
<td>Baig, Jannat</td>
<td>407X12</td>
<td>The Absorption of Cobalamin as Active B12 in C. elegans as a Model for the Vegan Diet</td>
</tr>
<tr>
<td>Balla, Arul Vignesh</td>
<td>408X12</td>
<td>Analyzing Arg442His Variant of MYH7 Gene in Correlation to Heart Failure</td>
</tr>
<tr>
<td>Ballinger, Todd</td>
<td>701T12</td>
<td>Extraction of Copper (II) Nitrate From Water Through Electrolysis</td>
</tr>
<tr>
<td>Banks, Agota</td>
<td>409X12</td>
<td>Facilitation of Insulin Secretion using Ghrelin in Hyperglycemic Bombyx mori (silkworms)</td>
</tr>
<tr>
<td>Baron, William</td>
<td>1301X12</td>
<td>Can Polycyclic Aromatic Hydrocarbons be Removed From Curing Smoke using a Filter?</td>
</tr>
<tr>
<td>Barthel, Elizabeth</td>
<td>1702X12</td>
<td>The Effect of Tea Tree Oil on Acne-Causing Bacteria Growth</td>
</tr>
<tr>
<td>Bartholomew, Nicholas</td>
<td>160X12</td>
<td>The Properties and Applications of the Brachistochrone Curve</td>
</tr>
<tr>
<td>Basharmal, Adrees</td>
<td>2001T12</td>
<td>The Effect of Task Complexity on Time to Mastery for Machine Learning Agents</td>
</tr>
<tr>
<td>Beisler, John</td>
<td>901X12</td>
<td>Testing the Effects of Various Microplastics on the Fertility of Arbacia punctulata as a Method to Measure Pollution Toxicity</td>
</tr>
<tr>
<td>Last, First Name</td>
<td>Project No.</td>
<td>Project Title</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Bernart-Shenk, Gabriel</td>
<td>208T11</td>
<td>The Effect of Cell Phone Use on Reaction Times and Cognitive Flexibility</td>
</tr>
<tr>
<td>Bhangui, Isha</td>
<td>1401T11</td>
<td>Layer-by-layer Self-Assembly to Make Electrospun Chitosan Hydrophobic for</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Microbead Removal</td>
</tr>
<tr>
<td>Blondin, Julia</td>
<td>203T12</td>
<td>Sleep Deprivation</td>
</tr>
<tr>
<td>Bogucki, Colton</td>
<td>2103T12</td>
<td>EMS Duty Check</td>
</tr>
<tr>
<td>Bojja, Rashmi</td>
<td>1703T12</td>
<td>The Effect of Ayurvedic Remedies on the Inhibition of Enterobacter aerogenes</td>
</tr>
<tr>
<td>Bora, Zeneida</td>
<td>703T11</td>
<td>The Concentration of Blue Dyes in Drinks Using Beer’s Law</td>
</tr>
<tr>
<td>Bowman, Caitlin</td>
<td>501T12</td>
<td>Effect of Changing Heel Height on the Incidence of Dead Spot Phenomenon in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prosthetic Feet</td>
</tr>
<tr>
<td>Burbano, Nicolas</td>
<td>2114T12</td>
<td>Optimal Schedule Change Process Automated by a Computer Program</td>
</tr>
<tr>
<td>Carroll, Shane</td>
<td>1305T12</td>
<td>Development of a control surface reliant GPS Guided Recovery System During</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weather Balloon Descent to Facilitate Retrieval Efforts</td>
</tr>
<tr>
<td>Chakka, Vamsi</td>
<td>908T12</td>
<td>Measuring the Effect of Different Micro-Plastic Concentrations on Brine Shrimp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Artemia Mortality</td>
</tr>
<tr>
<td>Challis, Harry</td>
<td>1402X12</td>
<td>Determining the Effectiveness of United States Army Corps of Engineers Levee</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Construction in Hurricane Prone Areas</td>
</tr>
<tr>
<td>Chandra, Sonia</td>
<td>2201X12</td>
<td>An Investigation of the Potential of Combinations of Rosmarinic Acid and Thymol</td>
</tr>
<tr>
<td></td>
<td></td>
<td>for Treatment of Lung Cancer</td>
</tr>
<tr>
<td>Chandrasekar, Ramprasanna</td>
<td>1102X11</td>
<td>Effect of Material Composition on Immobilized Yeast Cell Ethanol Production</td>
</tr>
<tr>
<td>Chavvakula, Satya</td>
<td>1906T12</td>
<td>Homemade Hydroponic System VS. Commercial Hydroponic System</td>
</tr>
<tr>
<td>Chelluri, Sriya</td>
<td>1302X12</td>
<td>The Effect of the Wing Design on the Speed of a Wind Turbine</td>
</tr>
<tr>
<td>Chong, Ryan</td>
<td>1903T12</td>
<td>Remediating Aliara petiulata Affected Soil With Arbuscular Mycorrhizal Fungi</td>
</tr>
<tr>
<td>Choudhari, Rishabh</td>
<td>1407T12</td>
<td>Converting Desert Sand to Arable Soil</td>
</tr>
<tr>
<td>Christoph, Erin</td>
<td>1503X12</td>
<td>Effect of Carbon Sources on the Production of Microbial Cellulose</td>
</tr>
<tr>
<td>Conrow, Elijah</td>
<td>1801X12</td>
<td>Properties of Diffusion in Fluid Undergoing Magnetohydrodynamically Induced</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rotational Flow</td>
</tr>
<tr>
<td>Cordova Carrion, Ariana</td>
<td>502T12</td>
<td>Decellularized Colocasia esculenta as a Per fusable Bone Engineering Scaffold</td>
</tr>
<tr>
<td>Cosgrove, Raymond</td>
<td>2105T12</td>
<td>Stock Market Anticipations: Predicting Fluctuations in Stock Market Prices Using</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Neural Networks and Media Parsing</td>
</tr>
<tr>
<td>Cox, Katie</td>
<td>301X12</td>
<td>Stimulating Ketosis via Glucagon Ingestion as a Treatment for Obesity</td>
</tr>
<tr>
<td>Cox, Kevin</td>
<td>1704T12</td>
<td>Optimizing the Antibacterial Properties of Macroalgae</td>
</tr>
<tr>
<td>Dao, Ngoc-Tram</td>
<td>1202T11</td>
<td>The Effect of Air Pollution on Solar Panel Efficiency</td>
</tr>
<tr>
<td>Dawood, Tamana</td>
<td>203T12</td>
<td>Sleep Deprivation</td>
</tr>
<tr>
<td>Dawson, Samuel</td>
<td>2104X12</td>
<td>Creating a Computer-aided Method for the Automatic Quantification and Analysis of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Animal Behavior</td>
</tr>
<tr>
<td>Dean, Ashley</td>
<td>1901X12</td>
<td>How Does Fluctuating Sounds affect the Photosynthesis Rate in Plants</td>
</tr>
<tr>
<td>DelJarnette, Connor</td>
<td>209T11</td>
<td>Cricket Memory</td>
</tr>
<tr>
<td>Desai, Shaalini</td>
<td>602T12</td>
<td>The Effect of Serotonin (g) on Telomere Length (bp): a Contribution to Personalized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Treatments for Hormonal Conditions</td>
</tr>
<tr>
<td>Last, First Name</td>
<td>Project No.</td>
<td>Project Title</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------</td>
<td>---------------</td>
</tr>
<tr>
<td>DeThomasis, Michael</td>
<td>204T12</td>
<td>The Sociology of Door Holding With Teenagers</td>
</tr>
<tr>
<td>Di Girolamo, Jacob</td>
<td>1303X11</td>
<td>The Designing and Prototyping of Pneumatic Tools That Are Capable of Being Produced Using Additive Manufacturing</td>
</tr>
<tr>
<td>Dimitri, Brandon</td>
<td>1103X12</td>
<td>Comparing Various Electrolytes for Optimal H2 Production Via Water Electrolysis</td>
</tr>
<tr>
<td>Dodge, Riley</td>
<td>1504T12</td>
<td>The Effect of Types of Maglev Track on the Speed of the Train Car</td>
</tr>
<tr>
<td>Drew, Matthew</td>
<td>1201T12</td>
<td>The Effects of Temperature on Battery Storage</td>
</tr>
<tr>
<td>Duffield, Kylee</td>
<td>204T12</td>
<td>The Sociology of Door Holding With Teenagers</td>
</tr>
<tr>
<td>Eda, Ritika</td>
<td>1902X12</td>
<td>The Effects of Various Temperatures on the Size of Xylem (Data Ongoing)</td>
</tr>
<tr>
<td>Edwards, Madeleine</td>
<td>1701T10</td>
<td>The Effects of Biofilms on Bacterial Cultures</td>
</tr>
<tr>
<td>Ezera, Nneka</td>
<td>1403X12</td>
<td>The Creation of Sorbents from Natural Waste Material to Aid in the Remediation of Chemical Spills</td>
</tr>
<tr>
<td>Farooq, Amaar</td>
<td>1903T12</td>
<td>Remediating Aliara petiolata Affected Soil With Arbuscular Mycorrhizal Fungi</td>
</tr>
<tr>
<td>Filicetti, Peter</td>
<td>2105T12</td>
<td>Stock Market Anticipations: Predicting Fluctuations in Stock Market Prices Using Neural Networks and Media Parsing</td>
</tr>
<tr>
<td>Flaherty, Erin</td>
<td>502T12</td>
<td>Decellularized Colocasia esculenta as a Perfusable Bone Engineering Scaffold</td>
</tr>
<tr>
<td>Galdamez, Meybelin</td>
<td>418T12</td>
<td>A Survey of Handwashing Efficiency</td>
</tr>
<tr>
<td>Gandi, Arvinn</td>
<td>215T12</td>
<td>Factors Affecting Choice Blindness</td>
</tr>
<tr>
<td>Garcia, Miranda</td>
<td>103T12</td>
<td>The Effects of Caffeine on Heart Rate of Daphnia magna</td>
</tr>
<tr>
<td>Garrido, Cristina</td>
<td>103T12</td>
<td>The Effects of Caffeine on Heart Rate of Daphnia magna</td>
</tr>
<tr>
<td>Gil, Antonio</td>
<td>1705X11</td>
<td>Effect of Zeolites on Escherichia coli k12 Growth</td>
</tr>
<tr>
<td>Gilbert, Cassandra</td>
<td>2110T12</td>
<td>The Analysis of the Usability and Design of Medical Applications to Reduce the Rate of Accidental Drug Misuse in Older Users</td>
</tr>
<tr>
<td>Glidden, Meghan</td>
<td>2202X12</td>
<td>Eliminating Stroke Induced Deficits via Early Administration of Narcan</td>
</tr>
<tr>
<td>Goel, Himanish</td>
<td>2203X12</td>
<td>The Effect of Tulsi (Ocimum sanctum) on the Lifespan of Fruit Flies</td>
</tr>
<tr>
<td>Goldbeck, Sophia</td>
<td>902T11</td>
<td>Modeling a New Coral Mucus to Prevent Coral Bleaching: Determining the Resistance of Halomonas halodenitrificans Biofilm Formation to pH</td>
</tr>
<tr>
<td>Goodrich, Carter</td>
<td>903X11</td>
<td>The Relationship Between Electrical Conductivity of Soil and Elevation</td>
</tr>
<tr>
<td>Grantz, Kelly</td>
<td>213T12</td>
<td>The Effect of Different Desensitization Senses on curing Post-Traumatic Stress Disorder in Fruit Flies</td>
</tr>
<tr>
<td>Greenman, Lucy</td>
<td>603X12</td>
<td>Preventing Preterm Birth: Maximizing GSH Synthesis to Fight Oxidative Stress</td>
</tr>
<tr>
<td>Guardado Ayala, Ashley</td>
<td>216T12</td>
<td>The Effect of Full Spectrum Light on Cognitive Processing</td>
</tr>
<tr>
<td>Gusciora, Portia</td>
<td>101T12</td>
<td>The Effect of Dipeptide L-Carnosine VS Vitamin C on the Regrowth of Cells in Planarian</td>
</tr>
<tr>
<td>Haak, Melody</td>
<td>104X11</td>
<td>Analyzing the Position of Pholcidae in Their Web with Respect to Environmental Factors</td>
</tr>
<tr>
<td>Hajdo, Peter</td>
<td>1706X12</td>
<td>The Relationship Between Different Microbiota and Adaptation of Drosophila to High Altitude</td>
</tr>
<tr>
<td>Hale, Andrew</td>
<td>2106X12</td>
<td>Analyzing an Olfactory Sense Database Using Python to Facilitate Scent Manufacturing</td>
</tr>
<tr>
<td>Haley, Shelby</td>
<td>1904X12</td>
<td>The Effect of Purple Light on Brassica rapa</td>
</tr>
</tbody>
</table>
## LCPS Regional Science & Engineering Fair
### Projects by Student Name

<table>
<thead>
<tr>
<th>Last, First Name</th>
<th>Project No.</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hall, Luke</td>
<td>801X12</td>
<td>Analysis of Influenza Surveillance Data to Predict Vaccine Strains Using Computational Methods</td>
</tr>
<tr>
<td>Hanna, Casey</td>
<td>702X12</td>
<td>Enhancing Cellulose Degradation during the Pulping Process via Fenton Chemistry</td>
</tr>
<tr>
<td>Haque, Melissa</td>
<td>703T11</td>
<td>The Concentration of Blue Dyes in Drinks Using Beer’s Law</td>
</tr>
<tr>
<td>Helmann, Ryan</td>
<td>1707X12</td>
<td>The Survivability of Geobacillus stearothermophilus in Conditions Representative of Saturn’s Moon Enceladus</td>
</tr>
<tr>
<td>Hendi, Satreen</td>
<td>205X12</td>
<td>The Effect of Culture on the Concept of Beauty</td>
</tr>
<tr>
<td>Hernandez-Figueroa, Kyle</td>
<td>1708X12</td>
<td>Evaluation of the Antimicrobial Properties of Copper and Zinc Sulfate Infused Textiles</td>
</tr>
<tr>
<td>Herrington, Kelly</td>
<td>1202T11</td>
<td>The Effect of Air Pollution on Solar Panel Efficiency</td>
</tr>
<tr>
<td>Herz, Sara</td>
<td>2204T12</td>
<td>BACE1’s Impact on the Agility and Mental Processing of Ants</td>
</tr>
<tr>
<td>Hill, Kaitlin</td>
<td>1905X12</td>
<td>Symbiotic Relationship Aids Growth in High Geothermal Conditions</td>
</tr>
<tr>
<td>Hillis, Sean</td>
<td>1104X12</td>
<td>Utilizing Chlorophyll as the Photoactive Agent in a Solar Cell While Using PEDOT:PSS as a Semi-Coductive Substitute for Graphene</td>
</tr>
<tr>
<td>Ho, Jovia</td>
<td>1404X12</td>
<td>The Effect of Temperature on the Volume of Grease-Degradation Fulfilled by the Bacteria Serratia marcescens and Bacillus cereus in a Recycling Plant Simulation</td>
</tr>
<tr>
<td>Ho, Phu</td>
<td>1308T11</td>
<td>Utilizing Thermoelectricity to Create an Electric Generating Tire</td>
</tr>
<tr>
<td>Hosten, Taylor</td>
<td>1802X12</td>
<td>The Effect of Salt on the Diffraction and Refraction of Laser Light</td>
</tr>
<tr>
<td>Houston, Emma</td>
<td>1711T12</td>
<td>The Role of Exosomes on D. discoideum Aggregation</td>
</tr>
<tr>
<td>Howard, Madeline</td>
<td>2002X12</td>
<td>Testing the Reaction Time of Machine Learning</td>
</tr>
<tr>
<td>Huddleston, Jon</td>
<td>904X12</td>
<td>Effect of Seagrass on the Acidification of Coral Reefs</td>
</tr>
<tr>
<td>Hughes, Zachary</td>
<td>701T12</td>
<td>Extraction of Copper (II) Nitrate From Water Through Electrolysis</td>
</tr>
<tr>
<td>Indupuru, Vijayalakshmi</td>
<td>1906T12</td>
<td>Homemade Hydroponic System VS. Commercial Hydroponic System</td>
</tr>
<tr>
<td>Iyer, Vikram</td>
<td>916T12</td>
<td>The Effect of Iron Fertilization on Carbon Dioxide Absorption (ppm) by Coccolithophore Algae</td>
</tr>
<tr>
<td>Iyer, Yasaswini</td>
<td>302X12</td>
<td>Discovering the Efficacy of Antacids</td>
</tr>
<tr>
<td>Jackson, Taylor</td>
<td>105X12</td>
<td>A Study of Epigenetics and Alcohol Dependence: The Effect of Generational Progression on Vulnerability Towards Alcoholism in Drosophila melanogaster using the Capillary Feeder Assay (C.A.F.E)</td>
</tr>
<tr>
<td>Jassal, Karanvir</td>
<td>2107T11</td>
<td>Predicting Stock Price Trends using Machine Learning and Mathematical Modeling</td>
</tr>
<tr>
<td>Jolly, Madison</td>
<td>1304X12</td>
<td>Detecting Drowsiness at the Steering Wheel</td>
</tr>
<tr>
<td>Joshi, Vrushti</td>
<td>1405T10</td>
<td>Grow Greenly</td>
</tr>
<tr>
<td>Justo-Jaume, Carlos</td>
<td>206X12</td>
<td>The Implementation of Operant Conditioning on Red Harvester Ants to Teach the Concept of Zero</td>
</tr>
<tr>
<td>Kadhiresan, Subhashni</td>
<td>106X12</td>
<td>The Effects of Nicotine levels on the Embryonic and Sensory Development in Danio rerio Embryos</td>
</tr>
<tr>
<td>Kalluru, Mridula</td>
<td>602T12</td>
<td>The Effect of Serotonin (g) on Telomere Length (bp): a Contribution to Personalized Treatments for Hormonal Conditions</td>
</tr>
<tr>
<td>Kaloji, Anuraag</td>
<td>1406T12</td>
<td>The Effect of Microbial Cellulose on the Development of Non-plant Based Paper</td>
</tr>
<tr>
<td>Last, First Name</td>
<td>Project No.</td>
<td>Project Title</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Kamal, Nailah</td>
<td>1803X12</td>
<td>Determination of the Existence of Ratios that Explain the General Location of Planets in the Galaxy</td>
</tr>
<tr>
<td>Kanungo, Rishiraj</td>
<td>1305T12</td>
<td>Development of a control surface reliant GPS Guided Recovery System During Weather Balloon Descent to Facilitate Retrieval Efforts</td>
</tr>
<tr>
<td>Kapoor, Anika</td>
<td>107X12</td>
<td>Phenotypic Effects of Bacteria Microflora Transplant between a Lab Raised and a Nature Raised Drosophila</td>
</tr>
<tr>
<td>Karam, Gabrielle</td>
<td>1408T12</td>
<td>The Effect of iron (iii) Nitrate on the Efficiency of the Hydroponic Phytoremediation of Eruca satvia</td>
</tr>
<tr>
<td>Kelley, Bridget</td>
<td>108X12</td>
<td>The Effect of Hurricanes on the Population Distribution of Buteo jamaicensis (Red-tailed Hawk)</td>
</tr>
<tr>
<td>Khader, Sajjaad</td>
<td>2107T11</td>
<td>Predicting Stock Price Trends using Machine Learning and Mathematical Modeling</td>
</tr>
<tr>
<td>Khairul Eyani, Haikal</td>
<td>503X12</td>
<td>Utilization of Soft Robotics on Peroneal Nerve Injury</td>
</tr>
<tr>
<td>Khalif, Faduma</td>
<td>504X12</td>
<td>Utilizing Varying Wavelengths of Light to Investigate their Impact on β-Amyloid Plaque Growth</td>
</tr>
<tr>
<td>Khan, Amina</td>
<td>802X12</td>
<td>The Morphological Significance of Dysregulated Gene Expression in Extracellular Matrix Receptor Interaction in Pancreatic Ductal Adenocarcinoma</td>
</tr>
<tr>
<td>Khushabakht, Areej</td>
<td>1709T12</td>
<td>The Effectiveness of Peptide Antibiotics on Eliminating Bacteria</td>
</tr>
<tr>
<td>King, Christopher</td>
<td>501T12</td>
<td>Effect of Changing Heel Height on the Incidence of Dead Spot Phenomenon in Prosthetic Feet</td>
</tr>
<tr>
<td>Kinney, Spencer</td>
<td>1204T11</td>
<td>Effects of Polarizers on Solid-State Lasers</td>
</tr>
<tr>
<td>Kinney, Yaiza</td>
<td>1804X12</td>
<td>The Effect of the Angle of the Arm in Breaststroke on the Propulsion Force Generated</td>
</tr>
<tr>
<td>Kishore, Raj</td>
<td>2108X12</td>
<td>The Effect of the Type of Regression on the Accuracy of the Predicted House Prices</td>
</tr>
<tr>
<td>Klein, Alexander</td>
<td>1907X12</td>
<td>Finding the Optimal Combination of Essential Oils Extracted From Thymus vulgaris and Menta menthe x piperita to Deter Drosophila suzukii From Attractive Stimuli</td>
</tr>
<tr>
<td>Klinkam, Jessica</td>
<td>109X12</td>
<td>Organic Anthelminitics: The Effectiveness of Rotational Pasture System as a Natural Solution to De-Wormer Resistance</td>
</tr>
<tr>
<td>Kozlowski, Kaden</td>
<td>1807T12</td>
<td>Football Hits: How Hard are they Really?</td>
</tr>
<tr>
<td>Krishnan, Santosh</td>
<td>505X12</td>
<td>Reducing the Impact Force and Energy Dissipated by the Brain by Using an NS Honeycomb Structure</td>
</tr>
<tr>
<td>Kudum, Rasvik</td>
<td>1805X12</td>
<td>Modelling the Effect of Three-Body EMRI Systems on Resultant Gravitational Waves</td>
</tr>
<tr>
<td>Kulkarni, Ketaki</td>
<td>303X12</td>
<td>Effect of Vitamin B1 on Ethanol Degradation</td>
</tr>
<tr>
<td>Kulkarni, Varun</td>
<td>2109X12</td>
<td>SeeCodeRun: An Online Javascript Environment with Developer-Centered Features</td>
</tr>
<tr>
<td>Kundala, Srivasthav</td>
<td>207X12</td>
<td>The Effect of Brain Teaser App Difficulty on Reaction Time</td>
</tr>
<tr>
<td>Kuruba, Ramya</td>
<td>2205T12</td>
<td>Effects of Intrauterine Hypoxia on Physiological Brain Development in Zebrafish Embryos</td>
</tr>
<tr>
<td>Lear, Kaylin</td>
<td>208T11</td>
<td>The Effect of Cell Phone Use on Reaction Times and Cognitive Flexibility</td>
</tr>
<tr>
<td>Lee, Hannah</td>
<td>604X12</td>
<td>Investigating Vitamin C on the Effect of Insulin-Like Growth Factor I (IGF-I) Expression in Skeletal Muscles</td>
</tr>
<tr>
<td>Lenahan, Mackenzie</td>
<td>406T12</td>
<td>The Epigenetic Effects Of Low-Level Environmental Hydrogen Peroxide in Drosophila</td>
</tr>
<tr>
<td>Levene, Meredith</td>
<td>905X12</td>
<td>Plant’s Effect on Air Quality in Coal Firing Environments</td>
</tr>
<tr>
<td>Last, First Name</td>
<td>Project No.</td>
<td>Project Title</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Li, James</td>
<td>1205T11</td>
<td>Battling the Heat Island Effect: Improving the Heat Mitigation Properties of Cool Materials Through the Modulation of Surface Geometry</td>
</tr>
<tr>
<td>Li, Zhiyuan</td>
<td>304T11</td>
<td>Fighting Cancer &amp; Infections: Developing a Unique Medical-Grade Honey Which Maximizes Glucose Oxidase Activity</td>
</tr>
<tr>
<td>Liles, Simon</td>
<td>1505T12</td>
<td>The Effect of Various Carbon Based Covering Material for Super Capacitors on Total Energy Storage and Energy Density</td>
</tr>
<tr>
<td>Liles, Stuart</td>
<td>1505T12</td>
<td>The Effect of Various Carbon Based Covering Material for Super Capacitors on Total Energy Storage and Energy Density</td>
</tr>
<tr>
<td>Lin, Amber</td>
<td>209T12</td>
<td>Cricket Memory</td>
</tr>
<tr>
<td>Lin, Ze</td>
<td>2110T12</td>
<td>The Analysis of the Usability and Design of Medical Applications to Reduce the Rate of Accidental Drug Misuse in Older Users</td>
</tr>
<tr>
<td>Liu, Isha</td>
<td>1704T12</td>
<td>Optimizing the Antibacterial Properties of Macroalgae</td>
</tr>
<tr>
<td>Loeffler, John</td>
<td>1306X12</td>
<td>Why Companies Should Buy Old Trucks</td>
</tr>
<tr>
<td>Lu, Jessica</td>
<td>2103T12</td>
<td>EMS Duty Check</td>
</tr>
<tr>
<td>Lutterodt, Andrew</td>
<td>1407T12</td>
<td>Converting Desert Sand to Arable Soil</td>
</tr>
<tr>
<td>Mada, Samhitha</td>
<td>420T12</td>
<td>The Effect of NSAIDs on the Heart Rate (bpm) of Daphnia magna</td>
</tr>
<tr>
<td>Magill, Jayne</td>
<td>906X12</td>
<td>The Effect of Temporal Fluctuations on Pigment Deposition in Hippodamia convergens (Ladybird Beetle)</td>
</tr>
<tr>
<td>Maheshwari, Saarthak</td>
<td>1908T11</td>
<td>Increasing HPV-35 Antigen Production in Transgenic Nicotiana benthamiana Through Multiple Agrobacterium Transformation Techniques</td>
</tr>
<tr>
<td>Mahmoud, Sarem</td>
<td>111T12</td>
<td>A Survey of Comparative Aerial Animal Migration</td>
</tr>
<tr>
<td>Malhi, Karmine</td>
<td>410T12</td>
<td>The Effects of Natural Herbs (Green Tea and Gingko Biloba) on the Stress Behaviors in C. elegans Determined through Egg Count</td>
</tr>
<tr>
<td>Maloney, Grace</td>
<td>1405T10</td>
<td>Grow Greenly</td>
</tr>
<tr>
<td>Maloney, Sydney</td>
<td>1506T12</td>
<td>Developing a Water Filter Using Electrospun β-lactoglobulin Amyloid Fibrils</td>
</tr>
<tr>
<td>Mangan, Shea</td>
<td>605X12</td>
<td>Behavior Responses to Light Wavelengths of Rhodopsin Gene Mutants in Drosophila melanogaster</td>
</tr>
<tr>
<td>Markov Madanick, Justin</td>
<td>110X12</td>
<td>Veterinary Drug Delivery via Multi-lamellar Spherical Delivery Complexes Created via Reverse Spherification</td>
</tr>
<tr>
<td>Martin, Britney</td>
<td>506X12</td>
<td>Automated Suturing Device</td>
</tr>
<tr>
<td>Mason, Lauren</td>
<td>907X12</td>
<td>The Effect of BPA on Fruit Flies</td>
</tr>
<tr>
<td>Mathur, Surbhi</td>
<td>704T12</td>
<td>Developing a Low Cost, Non-Invasive Colorimetric Assay to Determine Atherosclerotic Burden</td>
</tr>
<tr>
<td>McFadden, Rebecca</td>
<td>1307X12</td>
<td>Altering Intersection Geometry to Improve Traffic Flow During Peak Hours</td>
</tr>
<tr>
<td>McKillop, Taylor</td>
<td>411X12</td>
<td>The Effect of Artemisia annua (Sweet Wormwood) on Aggregation in Red Ball Sponge Cells</td>
</tr>
<tr>
<td>McLain, Sophia</td>
<td>412X12</td>
<td>The Effect of Phytoestrogen on the Lifespan of the Drosophila melanogaster</td>
</tr>
<tr>
<td>Meyer, Sidney</td>
<td>413X11</td>
<td>The Effect of the Quantity of Astrocytes on Febrile Seizure Threshold</td>
</tr>
<tr>
<td>Mishra, Soumya</td>
<td>2111X11</td>
<td>Using Statistics to Solve the Problem of Sorting Big Data</td>
</tr>
<tr>
<td>Misra, Sneha</td>
<td>414X12</td>
<td>A Study to Create a Data Collector Capsule for the Gastrointestinal System</td>
</tr>
<tr>
<td>Last, First Name</td>
<td>Project No.</td>
<td>Project Title</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MoIz, Inaya</td>
<td>415X12</td>
<td>Effect of Aronia (chokeberry) on the Reduction of Amyloid-Beta Plaques, Caused by Neurodegenerative Death in C. Elegans</td>
</tr>
<tr>
<td>Moola, Shashank</td>
<td>1203T12</td>
<td>Harvesting Excess Attic Heat to Power a House</td>
</tr>
<tr>
<td>Moore, Madden</td>
<td>803X11</td>
<td>Detecting Multiple Cancers Through MicroRNA Biomarkers Through Different Machine Learning Algorithms and Statistical Analysis</td>
</tr>
<tr>
<td>Muppala, Rikitha</td>
<td>1703T12</td>
<td>The Effect of Ayurvedic Remedies on the Inhibition of Enterobacter aerogenes</td>
</tr>
<tr>
<td>Nalla, Rithvik</td>
<td>908T12</td>
<td>Measuring the Effect of Different Micro-Plastic Concentrations on Brine Shrimp Artemia Mortality</td>
</tr>
<tr>
<td>Nazzaro, Thomas</td>
<td>2206T11</td>
<td>Determining the Effects of Lactobacillus on the Mobility of a C. elegans Model of Parkinson’s Disease</td>
</tr>
<tr>
<td>Nguyen, Andy</td>
<td>2001T12</td>
<td>The Effect of Task Complexity on Time to Mastery for Machine Learning Agents</td>
</tr>
<tr>
<td>Nguyen, Christopher</td>
<td>902T11</td>
<td>Modeling a New Coral Mucus to Prevent Coral Bleaching: Determining the Resistance of Halomonas halodenitrificans Biofilm Formation to pH</td>
</tr>
<tr>
<td>Nguyen, Tue</td>
<td>1308T11</td>
<td>Utilizing Thermoelectricity to Create an Electric Generating Tire</td>
</tr>
<tr>
<td>Nibbelink, Benjamin</td>
<td>1309X12</td>
<td>A Study of a Canard-Wing Configuration with Various Canard-Winglet Characteristics</td>
</tr>
<tr>
<td>Niemann, Anastasia</td>
<td>1909X12</td>
<td>The Effect of Temperature on Zooxanthellae to Prevent Coral Bleaching</td>
</tr>
<tr>
<td>Niemiec, Natalie</td>
<td>1709T12</td>
<td>The Effectiveness of Peptide Antibiotics on Eliminating Bacteria</td>
</tr>
<tr>
<td>Njoku, Angel</td>
<td>210X12</td>
<td>The Effect of the Menstrual Cycle on Female Stress Response</td>
</tr>
<tr>
<td>Ntantang, Mpeh</td>
<td>305X12</td>
<td>Comparing the Effects of Eicosapentaenoic Acid and Arachidonic Acid on CL2006 C. elegans Disease Progressions</td>
</tr>
<tr>
<td>Pallinti, Pranavi</td>
<td>306T12</td>
<td>The Epigenetic Effects of Vitamin K1 and Folic Acid on Alzheimer’s Disease in Transgenic Model of Caenorhabditis elegans</td>
</tr>
<tr>
<td>Palnati, Saimanga</td>
<td>909X12</td>
<td>The Effect of Environmental Pollution on Plant Growth in Loudoun County, VA</td>
</tr>
<tr>
<td>Panyam, Anoop</td>
<td>910T12</td>
<td>Using Genomic Sequencing of Biofilm Bacteria to Assess Water Quality</td>
</tr>
<tr>
<td>Parikh, Rohan</td>
<td>304T11</td>
<td>Fighting Cancer &amp; Infections: Developing a Unique Medical-Grade Honey Which Maximizes Glucose Oxidase Activity</td>
</tr>
<tr>
<td>Patel, Dylan</td>
<td>1710T12</td>
<td>A Comparison of Variations of Essential Oils on the Inhibition of K12 Escherichia coli</td>
</tr>
<tr>
<td>Patel, Sohan</td>
<td>911X12</td>
<td>The Effect of Algae Strand on Light Distribution and Growth</td>
</tr>
<tr>
<td>Patnaik, Isaani</td>
<td>416X12</td>
<td>Assessing Polyphenolic Antioxidants on Cell Viability and Apoptosis in Medullary Thyroid Cancer</td>
</tr>
<tr>
<td>Paulus, Samantha</td>
<td>507T12</td>
<td>Effect of Decellularization On Assorted Plant Leaves To Create A Pseudo-Vascular Tissue</td>
</tr>
<tr>
<td>Payne, Gregory</td>
<td>2003X12</td>
<td>Using RandomForest Algorithmic to Predict Cancer Survivability</td>
</tr>
<tr>
<td>Pearsall, Sarah</td>
<td>212T12</td>
<td>The Effect of Testing Mentality on Test Results</td>
</tr>
<tr>
<td>Peterson, William</td>
<td>2112X12</td>
<td>Development of a Computer Aided System for the Classification of Breast Lesions from Mammogram Scans</td>
</tr>
<tr>
<td>Pham Tran, David</td>
<td>917T12</td>
<td>The Effect of Acid Rain on L. terrestris</td>
</tr>
<tr>
<td>Pimentel, Julia</td>
<td>1806X12</td>
<td>The Construction and Operation of a Portable Small-Scale Radio Telescope to Collect Electromagnetic Signals Emitted from Space</td>
</tr>
<tr>
<td>Pondugula, Soumya</td>
<td>2206T11</td>
<td>Determining the Effects of Lactobacillus on the Mobility of a C. elegans Model of Parkinson’s Disease</td>
</tr>
<tr>
<td>Last, First Name</td>
<td>Project No.</td>
<td>Project Title</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pongsugree, Aaron</td>
<td>1406T12</td>
<td>The Effect of Microbial Cellulose on the Development of Non-plant Based Paper</td>
</tr>
<tr>
<td>Popal, Marwa</td>
<td>1408T12</td>
<td>The Effect of Iron (III) Nitrate on the Efficiency of the Hydroponic Phytoremediation of Eruca satvia</td>
</tr>
<tr>
<td>Porter, Lauren</td>
<td>912X12</td>
<td>How Elevation Affects the Magnitude and Frequency of Tornadoes</td>
</tr>
<tr>
<td>Premkumar, Alfred</td>
<td>1310X10</td>
<td>Programmable Maglev System</td>
</tr>
<tr>
<td>Pruss, Payton</td>
<td>211T12</td>
<td>The Effect of Blue Light Exposure Versus Warm Light (&quot;Night Shift&quot;) Exposure on the Quality of Sleep in Persons Aged 16 Years and Older</td>
</tr>
<tr>
<td>Qillawala, Atiya</td>
<td>410T12</td>
<td>The Effects of Natural Herbs (Green Tea and Gingko Biloba) on the Stress Behaviors in C. Elegans Determined through Egg Count</td>
</tr>
<tr>
<td>Raavicharla, Megha</td>
<td>202T11</td>
<td>Investigating the Effects of Magnesium Supplementation on ADHD Using Drosophila melanogaster</td>
</tr>
<tr>
<td>Rabbani, Ayon</td>
<td>804T12</td>
<td>Predicting Biological Symptoms from Protein Binding and Docking Data Using Different PNPO Mutants as a Model</td>
</tr>
<tr>
<td>Rahman, Nafew</td>
<td>417T12</td>
<td>The Effect of Acne Ingredients on C. elegans</td>
</tr>
<tr>
<td>Raja, Mamona</td>
<td>417T12</td>
<td>The Effect of Acne Ingredients on C. elegans</td>
</tr>
<tr>
<td>Rao, Rohit</td>
<td>1409X11</td>
<td>Using a Drone to Find Plastic Bottles in Waterways</td>
</tr>
<tr>
<td>Raival, Nirzaree</td>
<td>306T12</td>
<td>The Epigenetic Effects of Vitamin K1 and Folic Acid on Alzheimer’s Disease in Transgenic Model of Caenorhabditis elegans</td>
</tr>
<tr>
<td>Reddy, Rachna</td>
<td>2205T12</td>
<td>Effects of Intrauterine Hypoxia on Physiological Brain Development in Zebrafish Embryos</td>
</tr>
<tr>
<td>Rentsch, Nicholas</td>
<td>1311X12</td>
<td>Dimples on Fan Blades in a Turbine</td>
</tr>
<tr>
<td>Rivas, Erick</td>
<td>404T12</td>
<td>Using Direct Current Stimulation to Treat Parkinson’s Disease at Different Stages using C. elegans as a Model Organism</td>
</tr>
<tr>
<td>Rizzo, Julia</td>
<td>913X12</td>
<td>The Effect of Sunscreen Pollution and rising Temperatures on D. magra</td>
</tr>
<tr>
<td>Rodriguez, Alexander</td>
<td>1312X12</td>
<td>HMGH MKII</td>
</tr>
<tr>
<td>Rodriguez Miller, Morgan</td>
<td>217T12</td>
<td>Questionnaire Based on the Behavior of Cheating in High School</td>
</tr>
<tr>
<td>Roman, Miles</td>
<td>111T12</td>
<td>A Survey of Comparative Aerial Animal Migration</td>
</tr>
<tr>
<td>Rosas, Kassandra</td>
<td>418T12</td>
<td>A Survey of Handwashing Efficiency</td>
</tr>
<tr>
<td>Safeer, Huzaifa</td>
<td>2204T12</td>
<td>BACE1’s Impact on the Agility and Mental Processing of Ants</td>
</tr>
<tr>
<td>Saljuki, Saba</td>
<td>606X12</td>
<td>Epigenetic Influence of Light Color on Pigment Deposition in Vanessa cardui (Painted Lady Butterfly)</td>
</tr>
<tr>
<td>Salter, Kristen</td>
<td>112X12</td>
<td>The Effects of Different Amounts of Blue Light on the Development and Behavior of Drosophila melanogaster</td>
</tr>
<tr>
<td>Sample, Malia</td>
<td>419X12</td>
<td>The Correlation Between Inversion Induced Climatic Factors and Asthma Prevalence</td>
</tr>
<tr>
<td>Sandhu, Amandeep</td>
<td>1710T12</td>
<td>A Comparison of Variations of Essential Oils on the Inhibition of K12 Escherichia coli</td>
</tr>
<tr>
<td>Santos, Kayla</td>
<td>805T12</td>
<td>(Mathematical) Modeling of Horizontal Gene Transfer Resulting in Antibiotic Resistance of Staphylococcus and Bacillus genera</td>
</tr>
<tr>
<td>Schear, Caleb</td>
<td>1204T11</td>
<td>Effects of Polarizers on Solid-State Lasers</td>
</tr>
<tr>
<td>Schlitzer, Rebekah</td>
<td>914X12</td>
<td>The Differences in Water Quality Throughout Loudoun County</td>
</tr>
<tr>
<td>Schloer, Gwyneth</td>
<td>1313X12</td>
<td>Mathematically Accurate, Double-Axis Microgravity Simulator</td>
</tr>
<tr>
<td>Last, First Name</td>
<td>Project No.</td>
<td>Project Title</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Schooling, Cassidy</td>
<td>113X12</td>
<td>The Influence of Lunar Cycles and Level of Station Pressure on the Incidence of Parturition in Virginian Beef Cattle Herds</td>
</tr>
<tr>
<td>Seekford, Anne</td>
<td>212T12</td>
<td>The Effect of Testing Mentality on Test Results</td>
</tr>
<tr>
<td>Sestak, Lindsey</td>
<td>114T12</td>
<td>The Effect of Vitamin D on the Stem Cells in Planaria and Caenorhabditis elegans</td>
</tr>
<tr>
<td>Seymour, Ian</td>
<td>1201T12</td>
<td>The Effects of Temperature on Battery Storage</td>
</tr>
<tr>
<td>Shah, Ria</td>
<td>1910X11</td>
<td>The Difference in Starch Accumulation in Lab Grown vs. Natural Grown Common Duckweed (Lemna Minor)</td>
</tr>
<tr>
<td>Shangraw, Joseph</td>
<td>1506T12</td>
<td>Developing a Water Filter Using Electrospun β-lactoglobulin Amyloid Fibrils</td>
</tr>
<tr>
<td>Shapero, Danielle</td>
<td>114T12</td>
<td>The Effect of Vitamin D on the Stem Cells in Planaria and Caenorhabditis elegans</td>
</tr>
<tr>
<td>Shrestha, Mitesh</td>
<td>423T12</td>
<td>The Effect of an Antibody-Chitosan Bio Gel on Ulcer Medication Delivery</td>
</tr>
<tr>
<td>Shukla, Dhara</td>
<td>420T12</td>
<td>The Effect of NSAIDs on the Heart Rate (bpm) of Daphnia magna</td>
</tr>
<tr>
<td>Sibay, Leah</td>
<td>421X12</td>
<td>Mutagenicity and Carcinogenicity of Artificial Turf</td>
</tr>
<tr>
<td>Siddiqui, Abeer</td>
<td>1507X12</td>
<td>The Effect of Natural Aggregates on the Compressive Strength of Concrete</td>
</tr>
<tr>
<td>Sidhu, Uday</td>
<td>910T12</td>
<td>Using Genomic Sequencing of Biofilm Bacteria to Assess Water Quality</td>
</tr>
<tr>
<td>Siebor, Konrad</td>
<td>1205T11</td>
<td>Battling the Heat Island Effect: Improving the Heat Mitigation Properties of Cool Materials Through the Modulation of Surface Geometry</td>
</tr>
<tr>
<td>Smith, Connor</td>
<td>422X12</td>
<td>Anesthesia Recovery Rate in Drosophila melanogaster via Chromotherapy</td>
</tr>
<tr>
<td>Smith, Lydia</td>
<td>1807T12</td>
<td>Football Hits: How Hard are they Really?</td>
</tr>
<tr>
<td>Smith, Margaret</td>
<td>1911X12</td>
<td>The Efficacy of a Combination of Arbuscular Mycorrhizal Fungi as a Potential Biocontrol Method for Meloidogyne incognita in Peas (Pisum sativum L. cv. Green Arrow)</td>
</tr>
<tr>
<td>Solomon, Samantha</td>
<td>213T12</td>
<td>The Effect of Different Desensitization Senses on curing Post-Traumatic Stress Disorder in Fruit Fries</td>
</tr>
<tr>
<td>Sosa, Steven</td>
<td>1504T12</td>
<td>The Effect of Types of Maglev Track on the Speed of the Train Car</td>
</tr>
<tr>
<td>Sosale, Medhini</td>
<td>1401T11</td>
<td>Layer-by-layer Self-Assembly to Make Electrospun Chitosan Hydrophobic for Microbead Removal</td>
</tr>
<tr>
<td>Srigiriraju, Krishna</td>
<td>2113X10</td>
<td>Attendance-Taking QR Code Scanner Prototype</td>
</tr>
<tr>
<td>Srinivasan, Kirthana</td>
<td>1908T11</td>
<td>Increasing HPV-35 Antigen Production in Transgenic Nicotiana benthamiana Through Multiple Agrobacterium Transformation Techniques</td>
</tr>
<tr>
<td>Stevens, Carson</td>
<td>915T12</td>
<td>The Effect of Heavy Metal Pollution on the Health of fish in the Potomac River</td>
</tr>
<tr>
<td>Stillman, Carson</td>
<td>1808X12</td>
<td>Mimicking Quantum Double-Slit Phenomena using Sound Waves and Linseed Oil</td>
</tr>
<tr>
<td>Sumathipala, Marissa</td>
<td>806X12</td>
<td>Next Generation Drug Discovery: A Novel In Silico Network-Based Approach to miRNA Drug Target Identification</td>
</tr>
<tr>
<td>Szabo-Borde, Chance</td>
<td>919T12</td>
<td>Construction Sites’ Effect on Freshwater Abstract</td>
</tr>
<tr>
<td>Tanamala, Rhea</td>
<td>214X12</td>
<td>Investigating the Effect of a Cyclic Caffeine Treatment on Reducing the Cognitive Deficits Presented by Attention Deficit Hyperactive Disorder (ADHD)</td>
</tr>
<tr>
<td>Taylor, Michael</td>
<td>2207X12</td>
<td>Bdellovibrio Bacteriovorus as Alternative to Common Antibiotics</td>
</tr>
<tr>
<td>Thakar, Dhairya</td>
<td>916T12</td>
<td>The Effect of Iron Fertilization on Carbon Dioxide Absorption (ppm) by Coccolithophore Algae</td>
</tr>
<tr>
<td>Thomas, Ashlyn</td>
<td>915T12</td>
<td>The Effect of Heavy Metal Pollution on the Health of fish in the Potomac River</td>
</tr>
<tr>
<td>Last, First Name</td>
<td>Project No.</td>
<td>Project Title</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Torres, Ericka</td>
<td>917T12</td>
<td>The Effect of Acid Rain on L. terrestris</td>
</tr>
<tr>
<td>Tran, Michelle</td>
<td>805T12</td>
<td>(Mathematical) Modeling of Horizontal Gene Transfer Resulting in Antibiotic Resistance of Staphylococcus and Bacillus genera</td>
</tr>
<tr>
<td>Tsuyuki, Emiko</td>
<td>1314X12</td>
<td>Determining the Efficacy of the Use of Commercial Off-The-Shelf Parts Exposed to Extreme Space Conditions During Cubesat Engineering</td>
</tr>
<tr>
<td>Upadhyay, Deven</td>
<td>423T12</td>
<td>The Effect of an Antibody-Chitosan Bio Gel on Ulcer Medication Delivery</td>
</tr>
<tr>
<td>Urbano, Steffanie</td>
<td>1508X12</td>
<td>Comparative Analysis of Adhesives</td>
</tr>
<tr>
<td>Valerio Montero, Daniel</td>
<td>215T12</td>
<td>Factors Affecting Choice Blindness</td>
</tr>
<tr>
<td>Valluri, Maanasa</td>
<td>1509X11</td>
<td>Second Skin Biodegradable Gel</td>
</tr>
<tr>
<td>Van Lenten, Alexis</td>
<td>918X12</td>
<td>The Effect of Contaminated Runoff on Local Bodies of Water</td>
</tr>
<tr>
<td>Vangaru, Srinivasav</td>
<td>804T12</td>
<td>Predicting Biological Symptoms from Protein Binding and Docking Data Using Different PNPO Mutants as a Model</td>
</tr>
<tr>
<td>Vemula, Sahithi</td>
<td>424X12</td>
<td>Dissolving Blood Clots: Investigating Vitamin A in a Porcine Models</td>
</tr>
<tr>
<td>Vergara, Fadia</td>
<td>1711T12</td>
<td>The Role of Exosomes on D. discoideum Aggregation</td>
</tr>
<tr>
<td>Vishnubhatla, Rohit</td>
<td>2114T12</td>
<td>Optimal Schedule Change Process Automated by a Computer Program</td>
</tr>
<tr>
<td>Warner, Collin</td>
<td>1315X12</td>
<td>The Effect of Helmet Chin Strap Orientation on Ability to Reduce Concussions</td>
</tr>
<tr>
<td>Warner, Corwin</td>
<td>1001X12</td>
<td>Using Arduino© Microcontrollers for Dual-Fuel Injection</td>
</tr>
<tr>
<td>Warner, Jordan</td>
<td>1912X12</td>
<td>The Effect of Neonicotinoid Pesticide Application Method on the Photosynthetic Rate of Supertunias</td>
</tr>
<tr>
<td>Wells, Brett</td>
<td>1913X12</td>
<td>The Efficacy of Cricket Meal as an Alternative Fertilizer to Fight World Hunger</td>
</tr>
<tr>
<td>Wertz, Alexander</td>
<td>425X12</td>
<td>The Effect Stress has on the Digestive System of Fruit Flies</td>
</tr>
<tr>
<td>West, Abigail</td>
<td>919T12</td>
<td>Construction Sites’ Effect on Freshwater Abstract</td>
</tr>
<tr>
<td>Williams, Caitlin</td>
<td>1316X12</td>
<td>A More Efficient Method to Sanitize Hands in Hospitals</td>
</tr>
<tr>
<td>Wolinsky, Rena</td>
<td>2115X12</td>
<td>The Development of the CIA (Cyber aggression/ Cyberbullying Intelligence Algorithm)</td>
</tr>
<tr>
<td>Wong, Sophie</td>
<td>115X12</td>
<td>Using Tardigrades as Bioindicators of Air Pollution</td>
</tr>
<tr>
<td>Wootten, Matthew</td>
<td>1602T11</td>
<td>Predicting Seizures Using Non-Spiking and Spiking Artificial Neural Networks in Sequence</td>
</tr>
<tr>
<td>Wotorson, Faith</td>
<td>1410X12</td>
<td>Testing the Quality of a Homemade Water Filter and Water Distiller</td>
</tr>
<tr>
<td>Wright, Trinity</td>
<td>507T12</td>
<td>Effect of Decellularization On Assorted Plant Leaves To Create A Pseudo-Vascular Tissue</td>
</tr>
<tr>
<td>Wu, Janie</td>
<td>704T12</td>
<td>Developing a Low Cost, Non-Invasive Colorimetric Assay to Determine Atherosclerotic Burden</td>
</tr>
<tr>
<td>Wu, Megan</td>
<td>1510T11</td>
<td>The Effect of Different Powders on Durability of Plastic Spoon Substitute</td>
</tr>
<tr>
<td>Yachamaneni, Dheeraj</td>
<td>1203T12</td>
<td>Harvesting Excess Attic Heat to Power a House</td>
</tr>
<tr>
<td>Yannam, Megha</td>
<td>1511X12</td>
<td>A Comparison of the Environmental and Antibacterial Effects of Biogenically and Chemically Produced Silver Nanoparticles using Danio rerio and Escherichia coli</td>
</tr>
<tr>
<td>Zelaya Amaya, Yassy</td>
<td>216T12</td>
<td>The Effect of Full Spectrum Light on Cognitive Processing</td>
</tr>
<tr>
<td>Zelaya-Ballon, Rossana</td>
<td>1712X12</td>
<td>The Effect of Pipe Material on Biofilm Formation via Vibrio fischeri</td>
</tr>
<tr>
<td>Last, First Name</td>
<td>Project No.</td>
<td>Project Title</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>Ziemann, Jacob</td>
<td>1914X12</td>
<td>The Effect of B-Nine on Photosynthetic Rates</td>
</tr>
<tr>
<td>Zipfel, Autumn</td>
<td>217T12</td>
<td>Questionnaire Based on the Behavior of Cheating in High School</td>
</tr>
</tbody>
</table>
### 2018 LCPS Regional Science Engineering Fair

#### Animal Sciences (100)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>101T12</td>
<td>Avasarala, Priyanka</td>
<td>The Effect of Dipeptide L-Carnosine VS Vitamin C on the Regrowth of Cells in Planarian</td>
</tr>
<tr>
<td></td>
<td>Gusciara, Portia</td>
<td></td>
</tr>
<tr>
<td>102X12</td>
<td>Awasthi, Neha</td>
<td>The Effect of Adding Dietary Algae on the Amount of Methane Released By Bos taurus as Tested in an Artificial Rumen</td>
</tr>
<tr>
<td>103T12</td>
<td>Garcia, Miranda Garrido, Cristina</td>
<td>The Effects of Caffeine on Heart Rate of Daphnia magna</td>
</tr>
<tr>
<td>104X11</td>
<td>Haak, Melody</td>
<td>Analyzing the Position of Pholcidae in Their Web with Respect to Environmental Factors</td>
</tr>
<tr>
<td>105X12</td>
<td>Jackson, Taylor</td>
<td>A Study of Epigenetics and Alcohol Dependence: The Effect of Generational Progression on Vulnerability Towards Alcoholism in Drosophila melanogaster using the Capillary Feeder Assay (C.A.F.E)</td>
</tr>
<tr>
<td>106X12</td>
<td>Kadhiresan, Subhashni</td>
<td>The Effects of Nicotine levels on the Embryonic and Sensory Development in Danio rerio Embryos</td>
</tr>
<tr>
<td>107X12</td>
<td>Kapoor, Anika</td>
<td>Phenotypic Effects of Bacteria Microflora Transplant between a Lab Raised and a Nature Raised Drosophila</td>
</tr>
<tr>
<td>108X12</td>
<td>Kelley, Bridget</td>
<td>The Effect of Hurricanes on the Population Distribution of Buteo jamaicensis (Red-tailed Hawk)</td>
</tr>
<tr>
<td>109X12</td>
<td>Klinkam, Jessica</td>
<td>Organic Anthelmintics: The Effectiveness of Rotational Pasture System as a Natural Solution to De-Wormer Resistance</td>
</tr>
<tr>
<td>110X12</td>
<td>Markov Madanick, Justin</td>
<td>Veterinary Drug Delivery via Multi-lamellar Spherical Delivery Complexes Created via Reverse Spheronication</td>
</tr>
<tr>
<td>111T12</td>
<td>Mahmood, Sarem Roman, Miles</td>
<td>A Survey of Comparative Aerial Animal Migration</td>
</tr>
<tr>
<td>112X12</td>
<td>Salter, Kristen</td>
<td>The Effects of Different Amounts of Blue Light on the Development and Behavior of Drosophila melanogaster</td>
</tr>
<tr>
<td>113X12</td>
<td>Schooling, Cassidy</td>
<td>The Influence of Lunar Cycles and Level of Station Pressure on the Incidence of Parturition in Virginian Beef Cattle Herds</td>
</tr>
<tr>
<td>114T12</td>
<td>Sestak, Lindsey Shapero, Danielle</td>
<td>The Effect of Vitamin D on the Stem Cells in Planaria and Caenorhabditis elegans</td>
</tr>
<tr>
<td>115X12</td>
<td>Wong, Sophie</td>
<td>Using Tardigrades as Bioindicators of Air Pollution</td>
</tr>
</tbody>
</table>
The Effect of Dipeptide L-Carnosine VS Vitamin C on the Regrowth of Cells in Planarian

Priyanka Avasarala, Portia Gusciora

Stem cells play an important role in treating many cellular diseases such as Cancer, Alzheimer’s, and Sickle Cell Anemia, ext. And many times the cure and/or treatments for these diseases are expensive and/or unresponsive. However, if these stem cells can be effectively regrown in a more productive way, with a cheaper treatment and in the patients’ body itself though a simple dosage of a dipeptide or a vitamin, then it would prove a vital opportunity for people suffering from these diseases, by reducing the cost of the treatment, and/or providing a cure in general. The purpose of this experiment was to compare the effects of Dipeptide L-Carnosine versus Vitamin C on the regrowth of cells in planarian, which are comparable to human stem cells. The hypothesis was that the Dipeptide would have a larger effect on the growth in the worms. Each planarian was cut a constant amount and then separated into its own petri dish. After this they were split into 3 equal groups, Dipeptide L-Carnosine, Vitamin C and the Controls. The Vitamin C group, and the Dipeptide Group were further split into 3 subgroups where they were treated with different concentrations of their given treatments. The group that produced the ideal amount of regrowth in the planarian was the .0015 M Dipeptide L-Carnosine. The second was the .001 M concentration Vitamin C. However, overall the Dipeptide had the most affect on the regrowth in cells of the Planaria. As the higher concentration (.0015 M) of Vitamin C caused the planarian to disintegrate and the lower concentration (.0005 M) had no effect. These results provided information that supported the hypothesis that Dipeptide L-Carnosine will have a larger effect on the regrowth of cells in Planarian that Vitamin C will. Two major questions that arose were if this type of procedure could be used to regrow specialized cells immediately, skipping the middle step of the stem cells, and if this type of procedure could be used to even grow whole organs at some point as well.


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 Adding Dietary Algae on the Amount of Methane Released By Bos taurus as Tested in an Artificial Rumen

Neha Awasthi

Methane has been known to act as a greenhouse gas and contribute to the warming of the Earth. Cows release up to 200 liters of methane per day. Methane is created in the rumen of a cow through methanogenesis and is released through eructation. It has been proposed that changing the diet of cow has the ability to decrease the amount of methane produced.

Rumen fluid was obtained from the rumen of a cow. The liquid was placed in beakers, and a constant pH and temperature was maintained to replicate the conditions in a rumen. Beakers were manually stirred every half hour to replicate rumen turnover. Poryphyra yezonesis, Dashi kombu, or Undaria pinnatifida were added into the artificial rumen to determine the effect of seaweed on the amount of methane produced. The control beakers did not contain any seaweed. The released gas was collected, and then the volume of the gas and methane concentration was measured.

The control produced the least amount of gas and methane. For volume of gas produced, P value was greater than 0.05 for all experimental groups and control, indicating no significant difference (Tukey-Kramer). The algae groups were not significantly different from each other in amount of methane produced (ANOVA, P greater than 0.05). All three of the algae groups were significantly different from the control (P less than 0.05, Tukey-Kramer). The algae groups produced the most amount of methane, contradicting previous studies, so to gain a greater understanding of the effect of algae, more studies should be conducted.


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 Heart Rate of Daphnia magna
Miranda Garcia, Cristina Garrido

The purpose of this experiment is to capture the effects of performance-enhancing drugs such as caffeine on organisms. The independent variable in this experiment is the different levels of caffeine that the Daphnia magna are exposed to and the dependent variable is the different heart rate of each Daphnia. The control group in this experiment is the Daphnia not being exposed to anything other than water and food. Based on the findings that have been accumulated so far there are no significant long-term effects on the daphnia’s heart rate. The tank that has 30 mL of caffeine has had a minor increase but no significant change. The hypothesis is if Daphnia magna is exposed to higher concentrations of pure caffeine, then they will respond with increased stress levels and heart rate. Based on the statistical tests performed the hypothesis has not yet been proven to be supported. This experiment is still ongoing and may be subject to change if not major changes are reported. Further research could explore the effects of different performance enhancement drugs on the heart rate.


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).
Analyzing the Position of Pholcidae in Their Web with Respect to Environmental Factors  
Melody Haak

Spiders are some of the most useful creatures in the animal kingdom, due to their predatory tendencies, and also some of the most unique, as their webs are still a mystery to scientists worldwide. It is known that Pholcidae (Cellar Spiders) webs are made up of masses of fibrous material that they use to ensnare prey, but the research regarding other uses for webs does not exist. This project explores the relationship of dependency that Pholcidae have with their webs, specifically in relation to environmental factors such as light and wind. To do this, an artificial environment was created that allowed the spiders to live comfortably while enabling them to be affected by light and wind from 360 degrees around the cage. A lamp and fan were placed at each cardinal direction and the spider’s angle from the center of the web was measured to find out if there was a common reaction the spiders shared when affected by factors commonly found in nature. After testing was concluded and statistical tests were run, it was found that the spiders typically used their webs as shelter and hid from the light and wind by staying on the opposite side from where the components originated. However, the p-values with regard to the direction of origin being .566 from the North, .395 from East, .869 from South, and .402 from West, the results are much too high to suggest any correlation.


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 of Epigenetics and Alcohol Dependence: The Effect of Generational Progression on Vulnerability Towards Alcoholism in Drosophila melanogaster using the Capillary Feeder Assay (C.A.F.E)

Taylor Jackson

The purpose of this study is to assess if the epigenetic influence of alcohol dependence remains in subsequent generations. Drosophila melanogaster (common fruit fly) were placed in a modified version of the C.A.F.E assay using 20 ul capillary tubes of: yeast+sucrose; yeast+sucrose; ethanol+yeast+sucrose; quinine+ethanol +yeast+sucrose or yeast+sucrose. D. melanogaster were exposed to treatment groups for 4-days and amount of solution left in capillary tubes was recorded every 24 hours. D. melanogaster were bred and subsequent F1 were exposed to the same treatment groups for 4 days to determine how alcohol dependence development passed from Parent (P) to F1.

Progressional development towards ethanol over food began day 3 for P with significant preference of ethanol over food (p<0.05), ethanol remaining mean 5uL, food mean 12.5uL. F1 had significant preference of ethanol over food(p<0.05) day 3. Ethanol remaining mean 0uL, food 6.625uL. F1 had significantly lower mean (p<0.05) ethanol remaining day 3 compared to P. In quinine+ethanol P displayed significant preference of quinine+ethanol(p<0.05) day 3, mean 2.667uL remaining compared with mean food remaining 6.714uL. F1 preference of quinine+ethanol over food began day 1. Mean quinine+ethanol remaining 0.625uL, food 5.125uL. Day 1 comparison quinine+ethanol remaining between F1 and P proved F1 mean to be significantly lower(p<0.05). These results display strong evidence to support F1 developed a stronger alcohol dependence than P.


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 - 2018

The Effects of Nicotine levels on the Embryonic and Sensory Development in Danio rerio Embryos
Subhashni Kadhiresan

Exposure to nicotine during embryonic development causes developmental problems. Nicotine levels have been shown to impair embryonic development in a fetus. The purpose of this study is to further add to current research on effects of nicotine on the sensory development of D. rerio embryos by performing a touch sensory assay and evaluating embryonic development.

Hatch rates and swimming distance upon applied stimulus in D. rerio embryos were compared following exposure to different concentrations of nicotine: 0 mg/mL, 0.005 mg/mL, 0.01 mg/mL, 0.02 mg/mL. Hatch rates were compared by ANOVA and t-test analysis. The ANOVA showed a significant difference between all groups for hatch rates (P<0.05). On Day 3, the mean hatch rates in 0.005 mg/mL Nicotine solution were significantly higher (p<0.05) than in 0.0, 0.01, 0.02 mg/mL Nicotine solutions. On Day 5, the mean hatch rates in 0.005, 0.01, 0.02 mg/mL Nicotine solutions were significantly higher (p<0.05) than in 0 mg/mL solution. On Day 7, the mean hatch rates in 0 mg/mL solution were significantly higher (p<0.05) than in 0.02 mg/mL Nicotine solution. On Day 7 most of the control treated D. rerio had hatched when compared with nicotine treated D. rerio. As a result, nicotine had a significant effect by decreasing the amount of time necessary for D. rerio to hatch while increasing mortality rates of unhatched embryos. This research can be used to further observe the effects of nicotine from tobacco products on fetal development. Data collection for the embryo development through touch sensory assay 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).
Phenotypic Effects of Bacteria Microflora Transplant between a Lab Raised and a Nature Raised Drosophila

Anika Kapoor

The gastrointestinal microflora is responsible for the development of the immune systems in humans; with the help of the gastrointestinal microflora bacteria, our bodies are able to protect themselves from infectious diseases. The relationship between humans and Drosophila is almost indistinguishable. For that reason, experimenting on Drosophila was ideal. By transferring the gastrointestinal microflora from a natureraised Drosophila onto a lab raised Drosophila, we are able to observe the effects it creates. The lab raised Drosophila are the ones that are taken out from their natural habitat and placed in a scientific lab where they are sanitized and rid of any nonessential bacteria. On the other hand, the natureraised Drosophila are the ones that were born in nature and grew up in nature.

The experiment starts off by the collection of natureraised Drosophila, using a fruit based trap. Pre-order a few materials from Carolina such as petri dishes, lab raised Drosophila, and Drosophila food. As you start collecting natureraised Drosophila, you can start your process of gathering phenotypic observations and collecting virgin lab raised Drosophila (once they arrive.) Once a good amount of natureraised Drosophila have been collected, start anesthetizing them and taking out their gastrointestinal microflora bacteria using a narrow edged spatula. The experiment requires that the gastrointestinal microflora bacteria be put into vials for the results to occur. Immediately after that is done set up the experimental vials, the Drosophila food, and a chart to record the data. With the virgin lab raised Drosophila, separate them into males and females and place them into the experimental vials. Once that is completed, you can start observing the Drosophila.

Data collected will be both quantitative and qualitative. Unfortunately, at least one vial from each trial was unsuccessful due to either absence of food and/or moistness in their food. According to the experiment, the vials that contained less gastrointestinal microflora bacteria demonstrated a longer life span and a higher rate of reproduction in contrast with the vials that had 15 gastrointestinal microflora 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 Hurricanes on the Population Distribution of Buteo jamaicensis (Red-tailed Hawk)
Bridget Kelley

As sea temperatures continue to rise, the number of hurricanes that occur each year has increased in both number and intensity. Thus the potential for North American habitat loss and animal displacement has increased. This includes the nesting and feeding grounds of *Buteo jamaicensis*, the red-tailed hawk.

The purpose of this research was to determine how hurricanes affect *Buteo jamaicensis* populations and may disrupt their distribution across the United States. *Buteo jamaicensis* counts from across the southeast and northeastern United States from the years 2012-2017 were collected along with Atlantic hurricane data from the years 2012-2017. Both were mapped and analyzed.

Analysis of *Buteo jamaicensis* population and distribution indicated steady population numbers within states analyzed during the years of 2012-2017. Even when a state was struck by a hurricane, *Buteo jamaicensis* population numbers remained consistent. Only slight decreases and fluctuations in population numbers were observed. A possible explanation for these results is the unequal number of hawk data centers located in each state. Some states only had one data center reporting *Buteo jamaicensis* counts, while others had twelve. The distance of hawk watch locations from the coastline was also considered, however, there was no significant difference in the population number of *Buteo jamaicensis* along the coast than there was inland. These majestic birds are partial-migrants, which makes interpreting their movements challenging. Additional information gleaned from such analysis will provide greater understanding of this raptors behavior.


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).
Organic Anthelminitics: The Effectiveness of Rotational Pasture System as a Natural Solution to De-Wormer Resistance

Jessica Klinkam

An anthelmintic (de-wormer) is a typically chemical, orally administered medication that is used to destroy internal parasitic worms in livestock and humans. These medications have been useful and effective in the past, but indiscriminate de-worming practices have led to increased resistance to the medication within the internal parasite populations. One solution to this problem is a Rotational pasture system. Rotational pasturing is the moving of livestock herds between different plots of pasture in an effort to allow the pasture to recover. This rotational movement also allows the parasites that the animals shed in their feces to die out, and to re-parasitize the individual animal. In this experiment the effectiveness of an organic alternative to anthelmintic medications, Rotational pasture system, was explored. Two northern Virginia farms, one that practices a Traditional pasturing (no rotation) and another that practices a Rotational system. A random, five individual fecal sampling was collected from both herds three separate times, and then each sample was used in a fecal floatation test to establish an individual parasite load. These individual parasite loads were then averaged out into an average herd parasite load for that sampling period. Once all three average herd parasite loads had been calculated the overall average parasite load for each system was calculated. The results showed that the farm that practiced a Rotational system had consistently lower parasite loads in their individual animals and overall. This and the low statistical P Value of 0.0003, shows that a Rotational system is an effective alternative to chemical anthelmintic medication for controlling parasite levels in a livestock herd.


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).
Veterinary Drug Delivery via Multi-lamellar Spherical Delivery Complexes Created via Reverse Spherification
Justin Markov Madanick

Alternatives to classic drug delivery pathways have opened new and improved treatment efficacy in almost all areas of medicine. One of these pathways is liposomal drug delivery, allowing a drug to be trapped into a liposome (either during its initial formation or by in vivo injection). This has allowed healers to deliver precise dosages of medication to dermatological ailments and malicious tumors.

Research was conducted to integrate reverse spherification to create liposome-like structures designated as "RevSomes" (multilamellar spherical delivery complexes created via reverse spherification). The purpose of constructing these RevSomes was to create alternative liposomal-like drug delivery pathways to intestinal ailments often seen in veterinary science. Probiotics were injected into RevSomes as a drug-like model to observe transfer of the drug from the delivery complex through organic intestinal membranes into the targeted location of treatment. All liposome-like bodies were successful in the transfer of probiotic bacteria.

RevSomes provide a prototype for cheaper, easily created, effective drug delivery through their adhesion onto a desired point of interest such as ulcers and tumors in animals. As modeled using hog intestinal membranes, rates of drug transfer via these pods may prove useful in many medical fields. These microstructures may enhance treatment efficacy by delivering healing or immune boosting drugs to specific locations. Further research would entail testing the efficacy of the delivery of various types of drugs using RevSomes and the precision that this delivery mechanism provides. This may allow alternate types of veterinary treatment and enhance the quality of life for animals.


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 Survey of Comparative Aerial Animal Migration
Sarem Mahmood, Miles Roman

Numerous studies have shown that aerial animals such as bats, butterflies, and birds tend to migrate from the south to the north in summers, and from the north to the south in winters. If an aerial animal migrates in one given place, then the migration itself should have notable relations to similar animals’ migrations in different parts of the world. An example of this is how bats (chiroptera) seasonally migrate north in the summer to south in the winter regardless of whether they live in Africa or the Americas. It is well known that that those who live in different places grow and develop differently from their counterparts in a separate region (Grant, P. R., 2006). However, it is suspected that this principle may apply to the migration of animals belonging to the same family in different places. Therefore, the issue that was attempted to be understood was whether there was indeed a correlation between these movements. In order to research the topic several papers and databases were reviewed and gathered data from, and compiled together into one document. From the data that was obtained, it was clear to see that there is indeed a correlation between the migration pattern of species. Although this data was previously assumed, through research it can now be successfully proven. In the future, it is hoped that the data that was compiled together will be able to influence the actions of the world around us.


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 Different Amounts of Blue Light on the Development and Behavior of Drosophila melanogaster

Kristen Salter

The emergence of new technology over the past several decades has solved many problems society has faced for centuries, but it has also created new ones. Little is known about the effects of the blue light that is emitted from much of this new technology. The purpose of this experiment is to test the effect of different amounts of blue light on the development and behavior of Drosophila melanogaster. This experiment’s intention is to develop a firm understanding of how the blue light that is radiated from phones, tablets, computers, and other technology affects humans as they grow and mature. Using lamps with either LED (blue light) or incandescent ("natural" light), vials of D. melanogaster were exposed to either or both types of light for different amounts of time throughout the day from egg to adulthood, attempting to simulate the natural 12 hours cycle of light and darkness (12 Blue/12 Darkness, 24 Darkness, and 9 “Natural”/3 Blue/12 Darkness). All variables were kept the same for the control group; the only change was exposing them to incandescent light instead of blue. Statistical analysis will be conducted to determine if the difference in light exposure affected the development and behavior of D. melanogaster over their life cycle, to help reveal if humans are being negatively affected by the blue light emitted from the devices they obsessively use daily. Other tests done directly on the experimental and control groups will help support the conclusions drawn from the statistical analysis.


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 Influence of Lunar Cycles and Level of Station Pressure on the Incidence of Parturition in Virginian Beef Cattle Herds

Cassidy Schooling

Throughout humanity's exceptionally long history of livestock rearing, producers have made observations about the behavioral tendencies of their animals to improve their management habits. It is through this tendency that the old wives' tale that says cattle tend to give birth during the full moon emerged, and that parturition is more likely in periods of low barometric pressures. If farmers had conclusive data showing either lunar phases or fluctuations in barometric pressure had an impact on timing of delivery, then producers could bring their cattle up from the fields on a certain interval of the lunar cycle/pressure level and have a vet on hand; potentially increasing the survival rate. The aim of this study was to determine whether there was a higher incidence of spontaneous deliveries during the full moon versus other lunar cycles, and during periods of low station pressure versus high station pressure.

To determine this, a retrospective analysis was performed using calving records from all areas of Virginia dating back to the year 1970 and determining the lunar phase of each birthdate to see if more calves tended to be born in full moon periods. To see if station pressure and the number of births were correlated, the number of calves born at an Angus farm in northern Virginia on each day going back to 2006 was matched with the station pressure at Dulles International Airport (19.5 miles apart). Following a statistical analysis, it was found that there was not a statistically significant correlation between lunar cycles and number of deliveries (P=0.1778). Additionally, it was found that air pressure corrected to sea level is not correlated to the number of deliveries (P=0.732).


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 Vitamin D on the Stem Cells in Planaria and Caenorhabditis elegans
Lindsey Sestak, Danielle Shapero

An experiment was conducted about vitamin D’s function, testing its effect on planaria regeneration speed, an *Caenorhabditis elegans* life span. Vitamin D served as the independent variable while growth rate and life span were the dependent variables. The planaria and *C. elegans* without vitamin D were the controls. The purpose of this experiment was to determine whether vitamin D will influence wound healing and tissue regeneration in organisms in correlation to humans. Humans have stem cells which serve a similar function to that of the worms and could be affected by vitamin D in the same manner as these organisms. After completing the experiment, it was concluded that the project was supported by the *C. elegans* as they had an increased longevity from the vitamin D. The hypothesis was partly refuted by the planaria as there was very little distinction between the control and those tested. The control *C. elegans* lived to an average of 15 days from the beginning of the experiment while the worms submerged in Vitamin D are still living. The results after cutting the planaria exemplified that there was no increase in growth rate of the independent which was due to a variety of errors such as waiting too long to start the project, incorrect formulation of vitamin D, and inaccurate measurements. In response to the results of the experiment, future research could be conducted to confirm if there are health benefits from the effect of vitamin D on the stem cells of humans.


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 Tardigrades as Bioindicators of Air Pollution
Sophie Wong

Tardigrades, or water bears, are some of Earth’s hardiest creatures. These tiny organisms less than 1 mm long can survive extreme temperatures, high levels of radiation, and the loss of 90% of their body water. They can be found in every environment, from terrestrial to marine to freshwater. This project is investigating the air pollution in Northern Virginia using tardigrades as bioindicators of environmental health. Samples of moss and lichen were collected from several different locations in Virginia, and after rehydration, the tardigrades were identified to species or genus. The distribution of tardigrade species and the population density may also show an association with the type of vegetation the sample was found on, the environment they live in, as well as their exposure to pollutants. Preliminary data indicates that in area with higher air quality indices (meaning more pollutants), there are fewer tardigrades, and in high-pollution samples that did have tardigrades, there is a higher proportion of tardigrades unable to survive dehydration. Future research could include identifying environmental pollution factors that affect tardigrade rehydration, as well as investigating the effects of these pollutants on the known desiccation survival molecules used by tardigrades. As Northern Virginia becomes increasingly developed, the pollution levels will rise, and using tardigrades as bioindicators is an cheap and easy way to measure these 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).
<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>201X12</td>
<td>Allen, Hannah</td>
<td>The Correlation between Individual PERMA Scores and Increased Gratitude Expression</td>
</tr>
<tr>
<td>202T11</td>
<td>Amin, Nikita Raavicharla, Megha</td>
<td>Investigating the Effects of Magnesium Supplementation on ADHD Using Drosophila melanogaster</td>
</tr>
<tr>
<td>203T12</td>
<td>Blondin, Julia Dawood, Tamana</td>
<td>Sleep Deprivation</td>
</tr>
<tr>
<td>204T12</td>
<td>DeThomasis, Michael Duffield, Kylee</td>
<td>The Sociology of Door Holding With Teenagers</td>
</tr>
<tr>
<td>205X12</td>
<td>Hendi, Satreen</td>
<td>The Effect of Culture on the Concept of Beauty</td>
</tr>
<tr>
<td>206X12</td>
<td>Justo-Jaume, Carlos</td>
<td>The Implementation of Operant Conditioning on Red Harvester Ants to Teach the Concept of Zero</td>
</tr>
<tr>
<td>207X12</td>
<td>Kundala, Srivastav</td>
<td>The Effect of Brain Teaser App Difficulty on Reaction Time</td>
</tr>
<tr>
<td>208T11</td>
<td>Bernart-Shenk, Gabriel Lear, Kaylin</td>
<td>The Effect of Cell Phone Use on Reaction Times and Cognitive Flexibility</td>
</tr>
<tr>
<td>209T12</td>
<td>DeJarnette, Connor Lin, Amber</td>
<td>Cricket Memory</td>
</tr>
<tr>
<td>210X12</td>
<td>Njoku, Angel</td>
<td>The Effect of the Menstrual Cycle on Female Stress Response</td>
</tr>
<tr>
<td>211T2</td>
<td>Abad, Gino Pruss, Payton</td>
<td>The Effect of Blue Light Exposure Versus Warm Light (&quot;Night Shift&quot;) Exposure on the Quality of Sleep in Persons Aged 16 Years and Older</td>
</tr>
<tr>
<td>212T2</td>
<td>Pearsall, Sarah Seekford, Anne</td>
<td>The Effect of Testing Mentality on Test Results</td>
</tr>
<tr>
<td>213T2</td>
<td>Grantz, Kelly Solomon, Samantha</td>
<td>The Effect of Different Desensitization Senses on curing Post-Traumatic Stress Disorder in Fruit Flies</td>
</tr>
<tr>
<td>214X12</td>
<td>Tanamala, Rhea</td>
<td>Investigating the Effect of a Cyclical Caffeine Treatment on Reducing the Cognitive Deficits Presented by Attention Deficit Hyperactive Disorder (ADHD)</td>
</tr>
<tr>
<td>215T2</td>
<td>Gandi, Arvinn Valerio Montero, Daniel</td>
<td>Factors Affecting Choice Blindness</td>
</tr>
<tr>
<td>216T2</td>
<td>Guardado Ayala, Ashley Zelaya Amaya, Yassy</td>
<td>The Effect of Full Spectrum Light on Cognitive Processing</td>
</tr>
<tr>
<td>217T2</td>
<td>Rodriguez Miller, Morgan Zipfel, Autumn</td>
<td>Questionnaire Based on the Behavior of Cheating in High School</td>
</tr>
</tbody>
</table>
The Correlation between Individual PERMA Scores and Increased Gratitude Expression

Hannah Allen

Positive psychology is a science that attempts to improve individual lives. The five main aspects of positive psychology are: positive emotions, engagement, relationships, meaning, and achievement (PERMA). By improving these aspects in one’s life, one can lead a more fulfilling and happy lifestyle, which could validate the implication of gratitude in the ever-present issue of mental health. The purpose of this study was to determine whether any correlation existed between gratitude expression and PERMA scores. Twenty participants were surveyed using a PERMA questionnaire. Over half of these individuals were instructed to conduct a weekly gratitude visit, which consisted of written and oral expression of thankfulness for four weeks. After the four-week period, the survey was again administered to all participants and the difference between the initial and final scores was measured.

Statistical analysis via t-tests resulted in the corroboration of the null hypothesis, which stated that there would be no correlation between PERMA scores and gratitude. While the imparity between PERMA scores was not significantly different, the largest variation existed between scores of meaning and achievement. The diminutive difference between the majority of PERMA scores is perhaps due to the small sample size of twenty. However, the larger variance within both meaning and achievement may be due to the impact of gratitude upon the subject. Continued research into the role gratitude plays in positive psychology is needed to determine any correlation between gratitude and PERMA scores and could be vital into unlocking an integral influence on mankind’s psychological well-being.


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 Effects of Magnesium Supplementation on ADHD Using Drosophila melanogaster

Nikita Amin, Megha Raavicharla

ADHD, a neurological condition that affects approximately 6.4 million children in the US, causes hyperactivity, impaired learning ability, and impulsivity. Although currently it has no cure, there are prescribed medications and recommended therapies for those who have ADHD. Oftentimes, mineral supplements are recommended to combat symptoms, however, these supplements have not been tested for their effectiveness. A study, however, did find that subjects with higher levels of magnesium in their hair and sera were less likely to have ADHD. Therefore, this experiment investigates if magnesium supplementation can reduce hyperactivity in ADHD subjects. *Drosophila melanogaster* will be used as a model organism with three specific strains. The wildtype flies represent subjects without ADHD. The DAT and DopR1 mutant flies replicate the dysfunction of dopamine neurotransmitters thought to cause ADHD in humans. The wildtype and mutant fly strains were placed on a regular diet and a magnesium supplemented diet. Then, flies were tested in a climbing assay to determine their activity levels. DAT and DopR1 flies are hyperactive climbers compared to wild-type flies. When the DAT flies on the magnesium enriched diet were compared to those fed the normal diet, there was a statistically significant decrease in activity, suggesting amelioration of hyperactivity. However, the opposite occurred with wildtype flies, which experienced a significant increase in activity when on the supplemented diet. This implies that the magnesium supplementation may be beneficial for treatment of ADHD but not recommended for those without the condition.


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).
Sleep Deprivation  
Julia Blondin, Tamana Dawood

Sleep deprivation not only negatively impacts a person's ability to function normally throughout the day, but also puts them at a risk for chronic diseases such as type 2 diabetes, alzheimer's, heart disease, mood disorders, sleep disorders and a decrease in their lifespan by 15%. Many of the diseases in human genetics are also present in fruit flies which helps us find treatments for the patients. Fruit flies are great test subjects for this research as they do not have pain receptors, share more than 50% of DNA with humans and have a short life span. Since humans and fruit flies have several genes, such as a gene known as period, and behaviors that are alike they have similar sleeping cycles. This gene links fruit flies to basically all mammals with the circadian rhythm. There are two sleep disorders linked to this gene as well; delayed sleep phase syndrome and familial advanced sleep phase syndrome. This research is important because it may help people in the modern world become more aware of the consequences of losing sleep and the diseases tied to it as well as lay a platform for further research on alzheimer's disease.

We will be experimenting the effect of sleep deprivation and caffeine on fruit flies. We predict that if fruit flies do not get the sleep they need then they will die faster and their flying pattern will change. We are going to keep flies in separate containers, and expose them to either constant vibration, caffeine, or both. We will have a control group. We are still currently gathering data.

https://academic.oup.com/sleep/article-abstract/40/11/zsx146/4209550  
https://academic.oup.com/hmg/article/13/suppl_2/R267/619697  
http://healthysleep.med.harvard.edu/healthy/matters/consequences/sleep-and-disease-risk

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 Sociology of Door Holding With Teenagers
Michael DeThomasis, Kylee Duffield

Western society is accustomed to the pleasantry of holding the door for one another, to the point where it is considered rude to drop the door. Through this experiment, it was discovered what percentage of teens will hold the door and explored possible reasons as to why; the data collected focused on the factor of distance. Data was collected through observation of students going into a high school. A line was drawn from the door to visually mark measurements away from the door in five feet increments.


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 Culture on the Concept of Beauty
Satreen Hendi

The concept of beauty changes through different areas of the world, but there is a purpose behind every definition of beauty and how much the concept differs between cultures. This study measures how women from ten different countries describe themselves and their satisfaction with themselves, how they compare themselves to other women, and what aspects of life, including the media, affect their concepts. Various databases and work by doctors and professors were analyzed and compared to determine trends in different subgroups. In almost every numerical set of data, the only repeated outliers came from Japan. Other than this, the points typically clustered in the same general area. If individuals are accustomed to a specific view of the concept of beauty, like that of culture and media, then they are more likely to believe that concept as well. Comparing the statistical data to the work by doctors and professors, it was found that those of Asian descent have the least representation of their own people in the media, and their data resulted in the lowest percentages regarding self-descriptors and comparison to other women. Ironically, they were also the least likely to say media and society sets too high of expectations. Further research would include more research focusing more on Asian culture, society, and media to gain a better understanding of what other factors could have influenced the results.


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 Implementation of Operant Conditioning on Red Harvester Ants to Teach the Concept of Zero
Carlos Justo-Jaume

Currently, humans and primates are the only organisms possessing the ability to comprehend the concept of zero. This is because zero is a complicated concept involving an understanding of the quantity of nothing in addition to understanding a number exists symbolizing the absence of something. This research endeavored to determine whether red harvester ants could understand the concept of zero through operant conditioning. Within a testing chamber, ants were given a choice of two different sides, one containing three blocks, the other five blocks. Sugar water was placed behind the least number of blocks. Every four days, a block was removed from each side until one side contained zero blocks, the other two. During trials consisting of zero blocks and two blocks, no sugar water was used to determine whether ants associated sugar water with the side with the less amount of blocks.

Statistical analysis indicated the null hypothesis, that ants would not learn to identify and learn the concept of zero through operant conditioning, was supported. While the number of ants choosing less blocks compared to more blocks was not statistically significant, as testing time progressed, more ants chose a side than not choosing a side, which led ants to the path of learning the concept of zero. A possible explanation is that ants do not have mental capabilities for learning the concept of zero. Continued research into what other organisms have the capacity to understand zero would increase possibilities for explanation regarding organismal intelligence and brain development.


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 Brain Teaser App Difficulty on Reaction Time
Srivasthav Kundala

Reaction time (RT) is a way of measuring the time between stimulus and an action caused by the stimulus. One way to measure RT is to record the time needed for a person to react accordingly to the stimulus. Many factors can affect reaction including age, gender, mental wellness, and whether the stimulus is auditory or visual. When reacting to stimulus, the impulses travel from the eye through the optic nerve to the brain, where it is then sent to the motor cortex. The brain then sends a signal to the motor neurons in the muscles, telling to press the button. As age increases, the fatty acid that forms the myelin sheath begins to break down causing the signals to travel slower. In this experiment, 20 people will attempt both difficulties of the teaser, easy and hard, and the app will automatically record the time needed for the person to react accurately to the stimulus. This experiment is testing the visual reaction time using brain teasers. The “easy” difficulty is where a color is given and a person must react to the stimulus by clicking on the correct colored circle. The “hard” difficulty adds the aspect of confusion where a random color text is inside the colored circle. The average time difference between the difficulties is being tested. Data is still being collected.


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 Cell Phone Use on Reaction Times and Cognitive Flexibility
Gabriel Bernart-Shenk, Kaylin Lear

Cell phone use affects one’s ability to respond appropriately to stimuli. However, it is uncertain if reaction times and cognitive flexibility are able to recover after intervals of no cell phone use. This experiment was conducted to show the effects of cell phone use and the ability to repair reaction times and cognitive flexibility. After weeks of testing, by taking an average of the data, the results showed that before cell phone use the reaction time was 0.33 seconds, after 10 minutes of cell phone use the reaction time was 0.34 seconds after 5 and 10 minutes of no cell phone use the reaction time was 0.31 seconds, and after 15 minutes of no cell phone use the reaction time was 0.30 seconds. The average results of the stroop color-word test showed that before cell phone use participants were answering 19.6 out of 20 cards correctly, after 10 minutes of cell phone use the average was 16.8, and after 15 minutes returned to the average of 19.6 The results conclude that cell phone use does negatively affect reaction times and cognitive flexibility. However, after 15 minutes of no cell phone use, reaction times and cognitive flexibility recover, equaling or even rivaling the results before cell phone use was permitted. Data is still being collected.

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).
Memory is the sum total of what we remember, and gives us the capability to learn and adapt from previous experiences. Crickets are known to locate their food using landmarks but not to specific lighting cues. We tested the ability of crickets, when they are both nymphs and adults, to use surrounding visual cues (flashing ultraviolet lights) to understand when their food will be given to them. This project is testing the response both the adult crickets and the nymphs have when they are exposed to ultraviolet light and to see if they retain this memory.

For our project, we are going to have a group of crickets that will be exposed to bright, ultraviolet flashing lights when food is presented. Another group of crickets will only be exposed to the bright, colored lights when they are adults, and a control group that will experience no light. We will need to have at least 15 crickets (5 in each group), three clear plastic containers, water and food, three cardboard boxes to cover the crickets, and a constant bright colored light.


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 Menstrual Cycle on Female Stress Response

Angel Njoku

The menstrual cycle can be broken up into 3 distinct phases: the menstrual period, the follicular phase, and the luteal phase. Throughout these phases, hormones such as estrogen and progesterone fluctuate, which is believed to cause changes in a woman’s mental state. The purpose of this study is to determine which phase in the menstrual cycle has the greatest effect on the female stress level. It is hypothesized that the luteal phase will have the most heightened reaction to stress. The luteal phase, the last 14 days of the menstrual cycle, is where estrogen levels are most volatile; this fluctuation is what can correlate to heightened stress symptoms. In order to gather data, participants were asked to fill out an online Google survey, responding to questions about the first day of their previous menstrual cycle, regularity, and various questions as indicators of current stress or lack thereof, on a scale from 1 to 5. These scores were then totaled to produce a scale from 5 to 25, with 5 being an indication of a high stress level. Results from the survey indicated that the luteal phase produced the highest level of stress according to a comparison of the median scores from each phase, thus supporting the hypothesis. Future research on the relationship between the menstrual cycle and mental health could utilize more advanced technology to look at the brain itself, which would be objective, versus a survey, which is subjective.


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 Blue Light Exposure Versus Warm Light ("Night Shift") Exposure on the Quality of Sleep in Persons Aged 16 Years and Older

Gino Abad, Payton Pruss

Mobile phones from the newest generation enable people to communicate and connect to virtual networks instantaneously from anywhere globally, which is enabled by the user's computer and internet connection features. With this growing amount of cellular use in day to day life, the ramifications of this constant exposure to strong blue lights, especially with the circadian rhythms, are often overlooked. Commonly used now is the "Night Shift" mode on a cellular device, which came out upon the arrival of the iPhone iOS 9.3 update. According to the Apple website, "Night Shift uses your iOS device's clock and geolocation to determine when it's sunset in your location, then it automatically shifts the colors in your display to the warmer end of the spectrum and may even help you get a better night’s sleep." With more recent updates, consumers may engage Night Shift whenever is most opportune to them. The idea behind it is that the warmer colors, which have longer wavelengths and less energy will allow your circadian rhythms to sync and allow for the mind to unwind and sustain a natural sleep-wake cycle even when exposed to digital blue light through everyday use. The heart rate and sensitive motion detectors on a Garmin Vivofit coupled with the Connect apps graphs and information that detail each how each hour of their rest was spent in light, deep, and awake sleep stages. The proposed hypothesis is that the exposure of the "Night Shift" mode on a person's cellular device will allow for a more regulated sleep cycle in comparison to blue light exposure. This experiment is designed to view the effect of blue light exposure versus warm light exposure ("Night Shift") on the quality of sleep in people aged 16 years old and over. Participants are asked to wear their wrist-worn device for a span of four nights, being assigned to either exposure to blue light the first for two nights, followed by two nights of warm light exposure, or vice versa, an hour before going to bed.


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 - 2018

**The Effect of Testing Mentality on Test Results**  
Sarah Pearsall, Anne Seekford  

The purpose of this experiment is to determine whether incentives affect test scores in high school students. In this project, students are required to take two tests, one with high stakes and another with low stakes. The experiment is being conducted in a high school, students are given two tests, one with low stakes, the other with high stakes. There are about 100 students in this experiment. About a third of students are given the incentive. The independent variable is the stake regarding the test, high and low. The dependant variable is the test scores. The teacher administers the test and uses a grading application to score the tests.

The results show that both the high stakes and low stakes test, the students scored higher with the incentive. The average of students high stakes without incentive test was a 68.138% while with incentives, students scored a 70.538%. Similarly, the average of students low stakes without incentive test was a 42.571% and the students scored a slightly higher 42.692%. In conclusion, our hypothesis, students will achieve higher test scores when rewarded an incentive, was supported by this data.

Further research can be conducted to solidify the results and to test variations of the experiment. Another study to be conducted is the effect of testing environments on the students’ test scores. This can then contribute to the study of mentalities in testing environments.


seq=1#page_scan_tab_contents


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 Desensitization Senses on curing Post-Traumatic Stress Disorder in Fruit Flies
Kelly Grantz, Samantha Solomon

We are doing this project because we want to see how desensitization works in fruit flies so that we can apply it to possible cures for Post Traumatic Stress Disorder (PTSD) in humans. We are trying to solve which sense is desensitized the fastest in fruit flies. To carry out this experiment we will split the fruit flies into three categories; the control group who will have no stimulus, the group that will be desensitized to sound, and the group that will be desensitized to light. The independent variable is the stimulus that we will be exposing them to (nothing, a loud sound, and a shadow.) After expose it to them, we will drop them, repeating this five times for each group to ensure that they associate the stimulus with the drop. We will continue to expose them to their designated stimulus until they become desensitized to it, counting how many times it takes (the dependent variable). We will know they are desensitized when they return to their food, as they leave it when they’re afraid. We will repeat the same steps to new sets of flies 12 times per category. Our results will show us how many times we needed to expose each group to their stimulus before they became desensitized per trial. We will show this using a histogram for each of the three categories. Using the results we will conclude which sense is easiest to desensitize, and discuss how we can apply that to humans.


Investigating the Effect of a Cyclical Caffeine Treatment on Reducing the Cognitive Deficits Presented by Attention Deficit Hyperactive Disorder (ADHD)

Rhea Tanamala

Attention Deficit Hyperactivity Disorder (ADHD) is a neurological disorder that results in having difficulty paying attention and learning new information. Studies have found that caffeine mimics amphetamine to provide cognitive benefits, especially helpful for adults with ADHD. The experiment will determine if the cognitive benefits provided by caffeine will have a significant role in combatting the cognitive deficits present in ADHD. Various weekly cyclical caffeine treatment schedules will be tested on both the wild type fly strain (Canton S.) and the ADHD fly model (Radish1) to determine their effectiveness in improving memory. An Aversive Phototaxic Suppression Assay is used to test the flies’ memory by teaching them a negative association they must remember, both prior to and after the treatment to see the overall change in behavior. After comparing the data from the treatments with and without caffeine, data suggests that the flies’ have a better memory of the association they learned with the administration of caffeine. Caffeine was administered on alternating days throughout the week, and data showed a significant improvement in both fly strains’ memory before and after the treatment. This suggests that the post-learning consumption of caffeine helps inhibit the cognitive deficits presented by ADHD.


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).
Factors Affecting Choice Blindness
Arvinn Gandi, Daniel Valerio Montero

The psychological field has a good understanding of what choice blindness is and how it relates to changes in sensory input; previous testing shows around 60 percent of test subjects fail to notice inconsistencies with their decisions between two options. It is unknown, however why some people notice and some remain unaware. Our experiment will determine whether outside factors like sleep behavior, workload, and knowledge of choice blindness, as well as the level of intrapersonal awareness (one's awareness of personal emotions, choices, motivations, etc...) affect choice blindness. We proposed that intrapersonal awareness would greatly affect choice blindness, since someone with a higher level should recognize what their choices would be.

Volunteers completed a survey that asked them about their sleep behavior, workload, and previous knowledge. Intrapersonal awareness was measured with the Myers-Briggs Personality Types, volunteers were asked to decide which personality type they are, and it was compared with the actual Myers Briggs test results. The choice blindness test asked volunteers to choose between two faces which one they believed is more attractive, and three out of those ten questions switched answers when asking them to confirm their choice.

Preliminary results were similar to previous findings, with half not noticing changes, 33 percent noticing all, and 17 percent noticing one change. However, there seems to be little to no correlation between workload or sleep and choice blindness results. Results were also inconsistent in regards to intrapersonal awareness. Data continues to be collected, but current findings show proposed factors do not play a significant role in determining choice blindness results.


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 Full Spectrum Light on Cognitive Processing
Ashley Guardado Ayala, Yassy Zelaya Amaya

As mental health has become a prevailing issue, a variety of light therapy sources have become available for dealing with mental issues. The alternative hypothesis is that if a classroom has full spectrum light, then they will process information faster on the Stroop test. Fifty subjects, ranging from 14 to 18 years of age, chosen at random, were placed in a room exposed to full spectrum lights and another with fluorescent lights for a 90-minute period over the course of two days. After the two days in each location, the subjects were given the Stroop test to assess the subjects overall cognitive processing in where the scores were then juxtaposed. The mean is 16.779 seconds for word set 1 and 26.791 seconds for word set 2. The mode is 16.044 seconds for word set 1 and 20.516 seconds for word set 2 in the location with fluorescent lights. The mean was 14.449 seconds for word set 1 and 24.747 for word set 2. The mode is 15.82 seconds for word set 1 and 31.038 seconds for word set 2 in the location with full spectrum lights. The alternative hypothesis was supported because the p value is <0.0001, and considered extremely significant. The type of light greatly influenced the subjects cognitive processing. Further research could explore the emotional impacts that full spectrum light provides for high school students along with health problems such as headaches that occur in school.


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).
Questionnaire Based on the Behavior of Cheating in High School

Morgan Rodriguez Miller, Autumn Zipfel

A survey was constructed based on the Genereux and McLeod journal, Circumstances Surrounding Cheating and was given to participants 18 years of age. The survey was organized to keep participants anonymous to ensure confidentiality. The main purpose was to analyze the behavior of the high school students on the aspects of cheating and comparing the results to the journal. The Genereux and McLeod journal surveyed college students at a university, while this study surveyed students at Briar Woods High School. The surveyed was created using the guidelines found on the journal and was posted onto Google forms, an online survey maker. The link to the survey was distributed and the consent form was signed by each participant. Most people tend to believe students cheat for the wrong reasons, but it is not always the case. So why do students cheat and does their environment play a factor? Students desire to do well academically and could resort of making decisions that violate the Honor Code. The survey was able to capture the reasons behind cheating, such as the overall long-term effects of their grades, family values, outside activities, and procrastination of school work. The data collected reflects a wide range of reasons for cheating. To receive an accurate data, we will continue to survey students, although fifteen is the minimum amount required to successfully match the Genereux and McLeod experiment. Looking at the results we currently have, there are patterns, where participants are more drawn to one answer than the others.


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).
2018 LCPS Regional Science Engineering Fair

Biochemistry (300)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>301X12</td>
<td>Cox, Katie</td>
<td>Stimulating Ketosis via Glucagon Ingestion as a Treatment for Obesity</td>
</tr>
<tr>
<td>302X12</td>
<td>Iyer, Yasaswini</td>
<td>Discovering the Efficacy of Antacids</td>
</tr>
<tr>
<td>303X12</td>
<td>Kulkarni, Ketaki</td>
<td>Effect of Vitamin B1 on Ethanol Degradation</td>
</tr>
<tr>
<td>304T11</td>
<td>Li, Zhiyuan Parikh, Rohan</td>
<td>Fighting Cancer &amp; Infections: Developing a Unique Medical-Grade Honey Which Maximizes Glucose Oxidase Activity</td>
</tr>
<tr>
<td>305X12</td>
<td>Ntantang, Mpeh</td>
<td>Comparing the Effects of Eicosapentaenoic Acid and Arachidonic Acid on CL2006 C. elegans Disease Progressions</td>
</tr>
<tr>
<td>306T12</td>
<td>Pallinti, Pranavi Raval, Nirzaree</td>
<td>The Epigenetic Effects of Vitamin K1 and Folic Acid on Alzheimer’s Disease in Transgenic Model of Caenorhabditis elegans</td>
</tr>
</tbody>
</table>

Category Student Count: 8
Stimulating Ketosis via Glucagon Ingestion as a Treatment for Obesity

Katie Cox

The increasing prevalence of obesity in America presents complex public health issues. Health risks associated with obesity include heart disease, stroke, type 2 diabetes, high blood pressure, and breathing problems. Studies to reduce obesity rates to acceptable levels over time by reducing weight in overweight and obese people have demonstrated that our ability to produce and maintain substantial weight loss is not good. During the metabolic state of ketosis, the body breaks down body fat for energy in response to insufficient glucose levels, producing ketones. Ketosis naturally occurs during fasting and lactation. Catalyzation of the inception of ketosis by using glucagon to mimic the effects of fasting would direct the body into a fat-burning state and lead to an overall reduction in body fat percentage.

Glucagon acts as a counter-regulatory hormone to insulin, promoting glycogenolysis, gluconeogenesis, and ketogenesis, signaled by an elevation of D-β-hydroxybutyrate and acetoacetate levels. This study seeks to access an alternative mechanism of entering into the state of ketosis in order to circumvent the 16-hour fasting window or dietary restrictions. Using C. elegans as a model organism, trials for various levels of glucagon concentrations were performed, in which the C. elegans fed from solutions of glucagon over a time span of 12 days. Urinalysis using reagent strips were used to test for the presence of ketone bodies in each group of worms. Finding a correlation between glucagon concentration and amount of ketone bodies produced indicates an entrance into the metabolic state of ketosis, and a P-value of 0.0247 validates glucagon ingestion as an alternative method of inducing a fat-burning state. Capitalizing on the potential of catalyzation of ketosis may mitigate the prevalence of obesity, improving health conditions and overall quality of life globally.


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).
**Discovering the Efficacy of Antacids**  
Yasaswini Iyer

Gastric ulcers are generally caused by an imbalance between aggressive factors (i.e., gastric acid, pepsin and secretion of gastrin) and protective factors (i.e., bicarbonate ion, mucus productivity and mucus secretion). Chronic gastritis appears to be generated from the over-secretion of gastric juices. The inhibition of acid secretion is believed to be the most important factor for treating gastric ulcers and gastritis. **This experiment examines the effectiveness of antacids, specifically with respect to the gastric mucosal barrier.** Consuming food triggers enzymatic reactions that alter pH creating both internal and external irritation. Techniques were employed that verified the efficiency of antacids in stabilizing the pH and preventing irritation of the stomach lining. Worms excrete a film similar to the mucus lining of the human stomach. In the first examination, the neutralization efficacy of commercial antacids with compared to the pure chemical compounds defined by the label on the product as its active ingredient. Secondly, an analyze of the effects of antacids on mucus production by worms in revealing insights on the treatment of ulcers. Further experimentation and data gathering is 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).
## Effect of Vitamin B1 on Ethanol Degradation

Ketaki Kulkarni

Alcohol Dehydrogenase (ADH) is a fast acting enzyme that metabolizes alcohol in the liver. This process creates toxic levels of an enzymatic byproduct that can accumulate. It has been a common practice to administer Vitamin B1 to individuals with high levels of alcohol and the byproduct. The reasoning is that Vitamin B1 resupplies the thymine needed in the liver which is affected by the toxic byproduct. To determine whether Vitamin B1 is being reacted on by ADH which would limit the production of the byproduct, a competition assay was performed. Using baker’s yeast as a source of ADH, various quantities of Vitamin B1 were tested versus a constant quantity of ethanol in the colorimetric assay. Each reaction was measured with a spectrophotometer at two wavelengths, one to ensure testing conditions were optimal. The other wavelength demonstrated the activity of the enzyme. The absorbance value for the largest quantity of Vitamin B1 (with ethanol) was 0.80 as compared to ethanol alone absorbance of 1.13. The data indicates there is competition between Vitamin B1 and ethanol. As the amount of Vitamin B1 decreased, the absorbance value increased indicating less impact from the Vitamin B1. Other vitamins have been shown to be beneficial to the liver health during alcohol exposure and further studies could include those vitamins with alcohol dehydrogenase enzymatic pathways.

---

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 - 2018**

**Fighting Cancer & Infections: Developing a Unique Medical-Grade Honey Which Maximizes Glucose Oxidase Activity**

Zhiyuan Li, Rohan Parikh

Glucose oxidase (GOX) is an enzyme in honey that catalyzes hydrogen peroxide, giving honey potential as a low-cost medical dressing, natural anticancer agent, and honeybee protectant against infections. Honeys that produce hydrogen peroxide can be classified into two categories: monofloral, in which one type of pollen is predominantly used to make the honey, and polyfloral, in which more than one type of pollen is used. However, hydrogen peroxide inhibitors in honey, including catalase and methylglyoxal (MGO), interfere with GOX activity. Thus, the purpose of this research is to investigate reasons for variations in GOX activity across honeys by comparing the effects of hydrogen-peroxide inhibitors on the GOX activity in polyfloral and monofloral honeys. The GOX activity of these honeys will be determined by testing hydrogen peroxide concentration in control and experimental groups, in which catalase, MGO, or both are inhibited. Data collection is ongoing; preliminary results show that blueberry honey is significantly less than the Pennsylvanian polyfloral honey (p is less than 0.05), and that the clover honey is significantly less than both polyfloral honeys tested. When the monofloral and polyfloral honeys were combined and statistically compared, the polyfloral honeys were significantly greater than their monofloral counterparts. This data supports the hypothesis that polyfloral honeys have higher levels of GOX activity due to greater pollen diversity in the honey. Thus, the GOX activity of polyfloral honeys may provide greater antibacterial activity and medicinal uses for wound application in diabetic patients compared to non-peroxidase monofloral honeys.


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 Effects of Eicosapentaenoic Acid and Arachidonic Acid on CL2006 C. elegans Disease Progressions

Mpeh Ntantang

With increasing prevalence, Alzheimer's disease (AD) is the 6th leading cause of death in the United States, whose risk increases by age, hereditary, lifestyle, and medical conditions. While there are no established preventative treatments for AD, many studies have observed a correlation between higher intake of omega-3 and lowered risk of dementia. Omega-6, although less extensively studied, also demonstrates potential in lowering risk of AD. The purpose of the experiment was to compare the effects of fatty acids on CL2006 C. elegans disease progressions.

Comparing omega-3, omega-6, and control groups will help determine which treatment is most protective against AD. The independent variable was the type of fatty acid, and the dependent variable was the paralysis rate. The control had no added supplement. Eicosapentaenoic acid (omega-3) and arachidonic acid (omega-6) were each extracted onto separate NGM plates. The temperature was upshifted to induce the paralysis phenotype. Then, a paralysis assay was implemented over an 8-hour period by counting the number of mobile CL2006 C. elegans at each time point. Omega-3 was most protective against AD, with a mean of 80.6% of non-paralyzed CL2006 C. elegans. Omega-6 and the control group had means of 63.2% and 60.2%, respectively. The calculated P-value of 0.4910 supports the null hypothesis that omega-3 and omega-6 fatty acids will not have significantly different effects on disease progressions. Being that the omega-6 group experienced slightly slower disease progression than the control group, further research can be done to observe arachidonic acid's underlying mechanisms in AD progression.


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).
Alzheimer’s Disease (AD) is a major cause of dementia, a loss of cognitive functions. These symptoms are hypothesized to be caused by beta-amyloid plaques between neurons. Deficiencies in certain vitamins, like folic acid and vitamin K, are correlated with an increased chance of Alzheimer’s disease. *C. elegans* is being used as a model organism for Alzheimer’s because the transgenic strain CL4176 exhibits plaques in its muscles, leading to paralysis after a temperature upshift. Vitamin K and folic acid reduce mortality due to Alzheimer’s disease in *C. elegans* by 90%. This reduction may be caused by epigenetics, the inheritance of traits based on altered gene expression instead of changes in the genetic code. *C. elegans* have demonstrated epigenetic inheritance and can pass on epigenetically encoded traits for up to 14 generations. Vitamin K and folic acid are involved in biochemical pathways that play a role in Alzheimer’s disease as well as epigenetic mechanisms such as DNA methylation and histone acetylation. This research investigates epigenetic mechanisms of Vitamin K and folic acid in the reduction of beta-amyloid plaques. The untreated progeny of the treated parental generation are expected to inherit the same epigenetic markers, leading to similarly decreased levels of beta-amyloid plaques as the treated parental generation. Preliminary data indicates F1 generations exhibit similar survival rates as treated parent generations. This research demonstrates that environmental factors such as diet and nutrition can impact gene expression not only in parent generation, but also subsequent generations to prevent diseases like AD.


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).
## Biomedical & Health Sciences (400)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>401X12</td>
<td>Acosta, Elsa</td>
<td>Development of a DNA Test for Sarcocystis neurona</td>
</tr>
<tr>
<td>402X12</td>
<td>Ahmad, Zohaa</td>
<td>Establishing the Effect of Turmeric on the Memory of C. elegans using a Chemotaxis Assay</td>
</tr>
<tr>
<td>403X12</td>
<td>Ali, Syed</td>
<td>The Effect of Various Computer Tasks on Human Eyes’ Blink Rate</td>
</tr>
<tr>
<td>404T12</td>
<td>Amaya Roca, Kevin</td>
<td>Using Direct Current Stimulation to Treat Parkinson’s Disease at Different Stages using C. elegans as a Model Organism</td>
</tr>
<tr>
<td>405X12</td>
<td>Anumukonda, Sujit</td>
<td>The Inhibition of Mold Growth on Bread</td>
</tr>
<tr>
<td>406T12</td>
<td>Assana, Hisham</td>
<td>The Epigenetic Effects Of Low-Level Environmental Hydrogen Peroxide in Drosophila</td>
</tr>
<tr>
<td>407X12</td>
<td>Baig, Jannat</td>
<td>The Absorption of Cobalmins as Active B12 in C. elegans as a Model for the Vegan Diet</td>
</tr>
<tr>
<td>408X12</td>
<td>Balla, Arul Vignesh</td>
<td>Analyzing Arg442His Variant of MYH7 Gene in Correlation to Heart Failure</td>
</tr>
<tr>
<td>409X12</td>
<td>Banks, Agota</td>
<td>Facilitation of Insulin Secretion using Ghrelin in Hyperglycemic Bombyx mori (silkworms)</td>
</tr>
<tr>
<td>410T12</td>
<td>Malhi, Karmine</td>
<td>The Effects of Natural Herbs (Green Tea and Gingko Biloba) on the Stress Behaviors in C. Elegans Determined through Egg Count</td>
</tr>
<tr>
<td>411X12</td>
<td>McKillop, Taylor</td>
<td>The Effect of Artemisia annua (Sweet Wormwood) on Aggregation in Red Ball Sponge Cells</td>
</tr>
<tr>
<td>412X12</td>
<td>McLain, Sophia</td>
<td>The Effect of Phytoestrogen on the Lifespan of the Drosophila melanogaster</td>
</tr>
<tr>
<td>413X11</td>
<td>Meyer, Sidney</td>
<td>The Effect of the Quantity of Astrocytes on Febrile Seizure Threshold</td>
</tr>
<tr>
<td>414X12</td>
<td>Misra, Sneha</td>
<td>A Study to Create a Data Collector Capsule for the Gastrointestinal System</td>
</tr>
<tr>
<td>415X12</td>
<td>Mofiz, Inaya</td>
<td>Effect of Aronia (chokeberry) on the Reduction of Amyloid-Beta Plaques, Caused by Neurodegenerative Death in C. Elegans</td>
</tr>
<tr>
<td>416X12</td>
<td>Patnaik, Isaani</td>
<td>Assessing Polyphenolic Antioxidants on Cell Viability and Apoptosis in Medullary Thyroid Cancer</td>
</tr>
<tr>
<td>417T12</td>
<td>Rahman, Nafew</td>
<td>The Effect of Acne Ingredients on C. elegans</td>
</tr>
<tr>
<td>418T12</td>
<td>Galdamez, Meybelin</td>
<td>A Survey of Handwashing Efficiency</td>
</tr>
<tr>
<td>419X12</td>
<td>Sample, Malia</td>
<td>The Correlation Between Inversion Induced Climatic Factors and Asthma Prevalence</td>
</tr>
<tr>
<td>420T12</td>
<td>Mada, Samhitha</td>
<td>The Effect of NSAIDs on the Heart Rate (bpm) of Daphnia magna</td>
</tr>
<tr>
<td>421X12</td>
<td>Shukla, Dhara</td>
<td>Mutagenicity and Carcinogenicity of Artificial Turf</td>
</tr>
<tr>
<td>422X12</td>
<td>Smith, Connor</td>
<td>Anesthesia Recovery Rate in Drosophila melanogaster via Chromotherapy</td>
</tr>
<tr>
<td>423T12</td>
<td>Shrestha, Mitesh</td>
<td>The Effect of an Antibody-Chitosan Bio Gel on Ulcer Medication Delivery</td>
</tr>
<tr>
<td>424X12</td>
<td>Vemula, Sahithi</td>
<td>Dissolving Blood Clots: Investigating Vitamin A in a Porcine Models</td>
</tr>
<tr>
<td>425X12</td>
<td>Wertz, Alexander</td>
<td>The Effect Stress has on the Digestive System of Fruit Flies</td>
</tr>
</tbody>
</table>

Category Student Count: 32
**Development of a DNA Test for Sarcocystis neurona**

**Elsa Acosta**

Equine Protozoal Myeloencephalitis (EPM) is caused by the common bacteria *Sarcocystis neurona* and causes severe neurological problems in horses, such as asymmetrical uncoordination and leaning (Dubey et al.). It is spread by hosts such as opossums and other small varmint common to rural areas. Testing and diagnosis of this disease is very difficult because the symptoms are similar to those of other neurological diseases (Gilmore). Tests for the bacteria are time consuming and expensive. Current modes of testing for the presence of *S. neurona* are Western blots and ELISA tests involving cerebrospinal fluid samples (Hoane et al.). However, EPM is often not diagnosed until postmortem (Interview with Bridgett McIntosh). The 18S ribosomal RNA gene is specific to *S. neurona*, thus making it an effective way to test for and isolate the bacterial genome among those of other bacteria (National Center for Biotechnology Information). The test developed through this project was made by using the 18S ribosomal RNA genetic sequence of *S. neurona* and attaching two primers. One primer is a probing primer which is complementary to the target DNA. It is also amine-modified which allows it to attach to the well. The other primer was biotinylated and bound with streptavidin with horseradish peroxidase. This primer is also complementary to the target DNA. The amine-modified primer attaches to the *S. neurona* RNA genetic sequence, if the sequence is present. The biotinylated primer bound to the *S. neurona* RNA genetic sequence and caused a color change, indicating a positive test result (Abcam). A negative test result was shown by no color change. This method is more specific, simpler, more efficient, and less costly than current Western blot and ELISA test methods which often yield false positives.


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).
Establishing the Effect of Turmeric on the Memory of C. elegans using a Chemotaxis Assay
Zohaa Ahmad

Alzheimer’s disease currently has no pinpointed causes nor cures, however turmeric, a bright yellow plant from the ginger family and native to South Asia, has recently been researched to serve as a preventative measure. The purpose of this study is to determine if turmeric can improve memory in both wild-type (N2, control) and apl-1 mutant C. elegans through a chemotaxis assay to test associative learning based on the sense of smell. Each strain of worms were fed either zero or twenty micromolar of turmeric in addition to E. coli and then put through a chemotaxis assay to see if associative learning could be maintained.

Both the N2 and apl-1 mutant nematodes that were exposed to turmeric and not exposed were tested through the chemotaxis assay. A chemotaxis and learning index were calculated for both. For the control nematodes, results yielded no attraction towards the butanone with both negative chemotaxis and learning index results. However, apl-1 mutants that were exposed and not exposed to turmeric showed a tendency towards the butanone location. This concludes that the turmeric did not play a significant role in the assay.

Further research can be done in the C. elegans with different means of testing memory in order to conclude if turmeric is indeed a preventative measure for Alzheimer’s disease. This experiment can be used as a preliminary experiment to determine the efficacy of C elegans tested with turmeric as a preventative measure to inhibit 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 Effect of Various Computer Tasks on Human Eyes’ Blink Rate

Syed Ali

Nowadays, many people utilize computers excessively where they stare at the screen for a long time, which results in blinking less than what is required for the human eye. They complete various tasks on the computer, and each task can have a different impact on the blink rate. Research shows that a typical blink rate is considered to be 10 to 16 blinks/min and during computer use, it has been significantly reduced. It is expected that playing Agar.io would have the least amount of blink rate, because it is the most cognitive task from the other ones, causing the eyes to be focused on the screen, resulting in a decline in the blink rate. In this research, the blink rate of the subjects was collected who were asked to complete various tasks on the computer. Subjects, ages 13 and above, were collected from Heritage High School and were asked to read text on paper and were required to complete five different tasks, which were presented in different order to each subject on computer, such as reading a passage called “On D Street” by Myla Goldberg and answering multiple choice questions related to it, chatting with Pewdiebot, playing Agar.io, watching “Why Do We Get Nervous?” taken from AsapSCIENCE channel on Youtube, and watching “Kids Tell Dads the Worst Thing They've Ever Done” taken from Jimmy Kimmel Live channel on Youtube. Subjects were videotaped in order to record their blink rate. The data was then collected and analyzed. Current data collected presents a mean baseline blink rate of reading from the paper as 11.33 blinks/min, reading from the computer at 19 blinks/min, chatting was 17 blinks/min, playing Agar.io was 9.33 blinks/min, watching AsapScience video was 19.67 blinks/min, and watching Jimmy Kimmel video was 14.33 blinks/min. To date, data suggests that playing Agar.io had the biggest effect on reduction of blink rate. Data collection is ongoing and once completed the overall results of the effect of various computer tasks on human eyes’ blink rate will be analyzed and presented.


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 Direct Current Stimulation to Treat Parkinson’s Disease at Different Stages using C. elegans as a Model Organism
Kevin Amaya Roca, Erick Rivas

Transcranial Direct current stimulation (tDCS) of neurons has been gaining popularity over the past decades because of its capability to enhance cognitive skills, reverse behavioral deficits, and mitigate neural diseases. Parkinson’s disease (PD) is a neurological disorder known to be degenerative and causes instability and suppresses movement. In PD, dopaminergic neurons of the substantia nigra within the basal ganglia, are degenerated. The purpose of this project is to study the effects of DCS on advancement of PD using C. elegans PINK-1 strain as a PD model organism and strain N2 as the control. A DCS device was used to apply a three volt current for 5 minutes with a 3 minute recovery after. A swim-to-crawl assay was performed to reflect dopaminergic activity. Adult and juvenile C. elegans were assayed separately to study the effects of DCS on advancement of Parkinson’s.

Results showed significant improvement in swim-to-crawl ability of adult PINK-1 C. elegans when treated with DCS (P less than 0.05, Dunn’s Multiple Comparisons test). N2 wild-type did not show significant differences as they were able to travel without stimulation. Data for juveniles are pending. Further research on neural stimulation treatment could provide a better understanding of how the DCS device enhances the functions of neurons to mitigate symptoms such as paralysis and hindered movement.


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 Inhibition of Mold Growth on Bread
Sujit Anumukonda

Mold is a type of fungus that grows on many food sources. It most quickly affects bread when it is stored in warm, damp places. I've chosen to do this experiment because over 24 million slices of bread are thrown away each year, and that is unacceptable. By finding a better way to store and preserve bread, the yearly wasted bread can be greatly reduced. By testing several different preservatives as well as storage methods and environments, I plan to achieve the most optimal storage method for bread. For the first trial, the bread was split up into three different groups: normal bread (control), bread with clove oil, and bread with a 25% increase in sugar. The loaves were baked, then cut into one inch thick slices, yielding a total of eight slices per type of bread. The bread slices were then placed into two different types of storage methods, wrapped in tin foil, and placed in Ziploc bags. The stored bread was then placed into two different environments, room temperature and refrigerator. The bread was then closely monitored every day, making note of when mold first appeared on the bread.

Due to this experiment still being in progress, there have been very few definite conclusions. At this time, only the 25% increase bread stored in foil and Ziploc bag, at room temperature has shown mold growth. The remaining bread is continuing to be monitored. The second trial will address several issues including equal sizes of loaves and more constant monitoring. There will also be a new variable: calcium propionate. These changes will provide more accurate, as well as a more real-world grasp at the topic at hand.


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 Epigenetic Effects Of Low-Level Environmental Hydrogen Peroxide in Drosophila
Hisham Assana, Mackenzie Lenahan

Hydrogen peroxide (H2O2) is a low-temperature sterilant for medical equipment and airplane interiors, workstations, and entire rooms. It is vaporized and eliminates bacteria through its oxidative ability. Then it is broken down into oxygen and water. It could potentially have harmful effects on transgenerational epigenetic inheritance based on its potential to oxidize enzymes, molecules, and DNA.

Its potential deleterious effects are being measured by observing its generational effect on lifespan using Drosophila. Drosophila were environmentally exposed to a 0.22% concentration of H2O2 through strips of filter paper soaked in H2O2 or distilled water. They were divided into groups exposed for 0, 1, 3, and 4 generations. The groups’ lifespans were measured each generation. Flies were observed for the presence of mutations. Results are pending.

People are exposed to H2O2 residue from the sterilization process without enough research supporting the safety of low-level H2O2 exposure. Future research can look at the effects over several more generations and physical mutations in the flies, as the flies DNA could mutate with long term exposure. H2O2 is useful but the full health effects must be known before safely implementing it in places like hospitals and aircrafts.


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 Absorption of Cobalamins as Active B12 in C. elegans as a Model for the Vegan Diet
Jannat Baig

There are many misconceptions about the vegan lifestyle, although increasing plants in ones diet can reduce carbon footprint. Many of the nutritional concerns regarding veganism revolve around protein, but the biggest concern of the vegan diet is actually microbe-produced vitamin B12. Vitamin B12 is important as a coenzyme in the body, particularly in cell differentiation and haemopoiesis, and there is debate regarding the presence of active B12 in a plant based diet. Vitamin B12 falls under a group of compounds known as corrinoids, and there are many subgroup cobalamins on the market which are interest to vegans. An experiment will be set up to test the absorption of cobalamins and other natural supplementations as plant based forms of vitamin B12, and C. elegans will be used as a model due to their high biological needs for vitamin B12 similar to humans. It is hypothesized that cyanocobalamin will be the most effective means of supplementation in the maintenance of healthy vitamin B12 levels in a vegan diet. Cyanocobalamin, along with hydroxocobalamin, happens to be in most food sources of vitamin B12 such as in eggs. B12 deficiency takes six generations in C. elegans to fully manifest, and testing will continue to give insight to the case of vitamin B12 deficiency in vegans. Further research needs to be done regarding the effect of inactive corrinoids, analogues, on overall vitamin B12 levels in the body.


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).
Analyzing Arg442His Variant of MYH7 Gene in Correlation to Heart Failure

Arul Vignesh Balla

An article published by Pubmed and NCBI stated that the mutation Arg442His in the gene responsible for the production of beta Myosin heavy chains (betaMHC) had a substantial effect on the possibility of the carrier developing heart failure. The MyH7 gene responsible for the production of the betaMHC protein has a number of mutations but the Arg442His missense mutation is the one that has the greatest impact on the function of the gene. However the article does not address the effects the mutation has on this cardiac remodeling and the function of the protein itself and its ability to bind to its antagonists. The hypothesis was if the mutant variant of the betaMHC protein is introduced to its antagonists then it will have a harder time binding to its antagonists resulting in a lower binding affinity than its original normal type counterpart. After extensive testing with a computational model and increasingly strict search areas the results show a marked difference between the mutant and original type when it came to their binding affinities with the antagonists with the results supporting the hypothesis and a loss of binding efficiency of the mutant with a p value of 0.001. The means for the wild vs. mutant version for the 75, 50, and 25 angstrom search area for actin were -7.567, -4.944, -8.356, -4.811, -4.2, -0.511 and for ATP were -7.778, -4.911, -8.478, -4.878, -4.878, -0.622 respectively. In the future, this research could be used to create diagnostic tests and alert doctors of possible warning signs for developing heart failure.


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 - 2018

**Facilitation of Insulin Secretion using Ghrelin in Hyperglycemic Bombyx mori (silkworms)**  
**Agota Banks**

Nine percent of the United States population is affected by type 1 diabetes, a disease that prevents the creation of insulin resulting in inability to remove excess glucose from the body. The newly discovered role of the human hormone, ghrelin, may regulate insulin secretion. The purpose of this research was to determine the effect of ghrelin on high glucose-hemolymph levels in *Bombyx mori* (silkworms). Hyperglycemic silkworms, used to simulate diabetes, were injected with 5%, 15%, and 25% ghrelin solutions. Hemolymph was collected and glucose assayed to determine glucose concentration in the silkworms. Although 25% ghrelin solution reduced the average glucose concentration from 365 µM to 205 µM, the 15% ghrelin solution lowered it to 202 µM indicating the lower dosage produced better metabolic breakdown of glucose. It was determined through statistical analysis using a t-test that the hypothesis, that there would be no difference in glucose levels regardless of the ghrelin concentration used as treatment, was refuted. The differences in the glucose levels were significant enough to conclude that the amount of ghrelin injected was an important factor in insulin secretion facilitation and glucose reduction. Further research would entail testing a wide range of ghrelin concentrations on a much larger sample group to be conducted over a longer period of time to fully examine the extent of ghrelin’s functions. The efficacy of these results will benefit the medical field specifically hyperglycemia because ghrelin shows promise as a new treatment to combat type 1 diabetes.


---

**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 Natural Herbs (Green Tea and Gingko Biloba) on the Stress Behaviors in C. Elegans Determined through Egg Count
Karmine Malhi, Atiya Qillawala

| The goal of the investigative group is to discover whether the herbs green tea and Gingko biloba will relieve stress responses in C. elegans. It is hypothesized that green tea and Gingko biloba will elicit an increased egg count and lifespan in C. elegans. Henceforth, if it can be supported that natural drugs are effective in increasing longevity in C. elegans, there is the potential for increased confidence in these herbs for daily human use. For this experiment, many generations of C. elegans were produced and experimented on. After the F2 generation the herb Ginkgo Biloba was added to one agar plate of C. elegans, the herb Green Tea was added to another agar plate, and lastly one agar plate of C. elegans were left as the control group. The experiment is still ongoing at the moment; therefore, results have yet to be determined. However, once data is collected, the results from the model organism can be expanded to humans for potential further research. |
| 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 Artemisia annua (Sweet Wormwood) on Aggregation in Red Ball Sponge Cells
Taylor McKillop

Approximately one-sixth of the world’s population suffers from neurological disorders that inflict slow and progressive dysfunction. As a result, neurodegenerative diseases are primarily debilitating and largely untreatable. *Artemisia annua* (Sweet Wormwood), widely used to treat parasitic diseases, has been found to reduce inflammation in some cases involving cholinesterase and nitric oxide.

The purpose of this research was to determine the effect of *Artemisia annua* in decreasing clumping in red ball sponge cells. These sponges were used as models because they produce spongin, a sticky chemical that maintains sponge body integrity that displays the same characteristics of sticky protein plaques which cause Alzheimer’s. The *Artemisia annua* solution reduced the clumping of cells and adhesion between cells causing a large dissipation of particles. The greater the concentration of the herb solution, the greater the dispersion of cells.

Further research would necessitate testing a wide range of *Artemisia annua* concentrations on a greater sample group. In addition, various other animal models such as *Caenorhabditis elegans* could be used to fully determine the extent of *Artemisia annua*’s effect. The utility of these results will benefit medical research because *Artemisia annua* shows promise as a possible treatment to combat neurodegenerative diseases.


Wilson-Sanders, Susan E., 2011. Invertebrate models for biomedical research, testing, and education. ILAR journal / National Research Council, Institute of Laboratory Animal Resources: 142.

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 Phytoestrogen on the Lifespan of the Drosophila melanogaster

Sophia McLain

Phytoestrogens are chemical compounds that are found in plants. Studies show that these basic chemical compounds act as endocrine disruptors. Flax oil has a high concentration of lignans, a specific type of phytoestrogen which prevents cortisol, the stress hormone, from attaching to the enzymes that facilitate its travel throughout the body. Attention Deficit Hyperactivity Disorder is classified as a neurobehavioral disorder in the DSM. The APA recently released that about 5% of children from 4 to 17 years of age are diagnosed with ADHD while the CDC says that it’s around 11% who are affected. There are also a high correlation between individuals with ADHD who also exhibit other disorders; anxiety, depression, bipolar disorder, Tourette’s, and even autism. Longitudinal studies show that high levels of cortisol in the body can lead to a shorter life. Although extensive research has been completed throughout the last decade, the concrete evidence as to whether it is brought on by genetics or environmental stressors is left to still be discovered. The purpose of this experiment was to test to see if the lignans found in flax oil helped lower cortisol (stress levels) and lead to prolonged life in *Drosophila melanogaster*. Flax oil was introduced into the diet of 80 *Drosophila melanogaster* while 80 received no oil. Transfer of flies to another vial took place one week later, acting as an environmental stressor causing their cortisol levels to rise. 62.5% in the experimental group survived while 37.5% survived in the control group. The significance of this research is to show that the lignans in flax oil can be the solution to a variety of different stress related disorders like ADHD.


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 Quantity of Astrocytes on Febrile Seizure Threshold
Sidney Meyer

The causes of febrile seizures, which can increase future possibility of epileptic seizures, are not well-known. Astrocytes are known to initiate epileptic seizures but their role in febrile seizures is unknown. This experiment examines the effect of the quantity of astrocytes on the duration of febrile seizures. A *Drosophila melanogaster* mutant, which lacks the microRNA 31a, is known to gradually lose and then regain astrocytes over its lifetime. This mutant was used to change astrocyte number over fly lifespan and it was compared to a control fly, which has a constant quantity of astrocytes. A heat shock procedure was repeated on each type of fly at selected ages and temperature stimuli to determine seizure durations for febrile seizure. A comparison of the seizure durations over the lifetimes of the flies as well as a statistical comparison between the seizure durations of the control and the miR-31a-lacking flies will be performed. Data collection is underway. A possible correlation between febrile seizure duration and astrocyte quantity could lead to new seizure preventative pathways based on astrocyte quantity manipulation.


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 - 2018

A Study to Create a Data Collector Capsule for the Gastrointestinal System  
Sneha Misra

This project was conducted to further systems of diagnosis for the gastrointestinal system. Currently, there are few methods of testing the health of the GI tract such as an endoscopy, exploratory surgery, and the newest introduction the Pill Cam. However, mild anesthesia is still needed to use the Pill Cam and it isn't cost efficient. In this project, a self sufficient bio pill concept has been created where the pill has a small window for the pill to collect data such as enzymes, proteins, and routine data such as pH or acidity levels. The capsule was 3D printed and for medical use can further be printed by biocompatible material that is safe for ingestion. The gel inside the pill collecting the data is crafted with a harmonious mixture of agar and polyacrylamide because the agar will allow collection of bigger particles and polyacrylamide will provide resilience for gel. In the lab, different concentrations were experimented with and when the right concentration between agar and polyacrylamide was found and tested in stomach conditions mimicked by one molar hydrochloric acid. To test efficiency of the gels, rate of diffusion was also tested between vinegar and hydrochloric acid; this information allows for the researcher to estimate the quantity of data that can be collected in the time of digestion. The applications of this study can provide early detection for health conditions by giving more people the opportunity to be tested for their health and help diagnose irritated bowel syndrome, gastroenteritis, or any other GI diseases. For further applications, this device can also be used to deliver insulin every 4 to 6 hours for diabetic 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).
Effect of Aronia (chokeberry) on the Reduction of Amyloid-Beta Plaques, Caused by Neurodegenerative Death in C. Elegans

Inaya Mofiz

Parkinson’s disease, a neurodegenerative disorder, is characterized by impaired movement, speech and mental processing. It is caused by aggregates of the protein alpha synuclein located in pre-terminal synapses of neurons. These aggregates lead to a chain reaction of inflammation, death, and function loss in the Dopamine neurons responsible for movement. Antioxidant therapy has emerged as a possible treatment to relieve oxidative stress, which causes chronic inflammation. Aronia has a unique composition of Flavonols, Anthocyanins, Proanthocyanidin and other antioxidants that protect and restore neurons, making it one of the most antioxidant rich foods that exist.

This research investigates the effect of Aronia on the amount of Dopamine neuron degeneration in C. Elegans (control DDP-2 strain and the transgenic DDP-1) exposed to Aronia concentrations of either 2 mg/mL or 6 mg/mL or 0 mg/mL(control). Speed of the L4 stage C. Elegans was assessed by taking videos on the Leica Microscope software and counting number of body bends per thirty seconds. DDP-1 strain with 2 mg/mL Aronia had higher mean number of body bends when compared without Aronia (p<0.05, t-test). DDP-1 strain had a higher mean number of body bends per thirty seconds than DDP-2 (p<0.05) without treatment. This indicates that Aronia may have the potential to alleviate oxidative stress in the Substantia Nigra, limiting a major contributing factor of Parkinson’s Disease. Future research may explore the extent to which each compound in Aronia produces this effect. Treatments for Parkinson’s disease could include components that are found to 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).
Assessing Polyphenolic Antioxidants on Cell Viability and Apoptosis in Medullary Thyroid Cancer
Isaani Patnaik

Medullary thyroid cancer (MTC) is a poorly differentiated cancer that is projected to have an increased incidence. While chemotherapy is used to tackle cancer proliferation, these drugs can induce adverse side effects and cause cell necrosis. Studies have found natural substances, such as antioxidants, contain bioactive compounds that interfere with cancer cell proliferation and initiate apoptosis. The purpose of this study is to analyze the synergistic effect of green tea, cocoa, and pomegranate - polyphenolic antioxidants - in reducing cell viability and inducing apoptosis in (MTC) cells.

Trials for each antioxidant at varying concentrations were run to assess the efficacy of each compound in killing a rat MTC cell line after 48 hours, using a phosphatase assay. Here it was found that 100mg/L green tea, 10mg/L cocoa, and 20mg/L pomegranate significantly reduced MTC cell viability, individually. 60mg/L and 100mg/L or more of cocoa and pomegranate, respectively, exhibited carcinogenic effects.

Combination trials were performed to analyze if an anticancer synergistic effect was present in the combination treatment. An ANOVA test indicated that the combination therapy had a statistically significant decrease in MTC cell proliferation compared to the control and individual antioxidant treatments (p-value less than 0.0001). A caspase assay will be performed to assert whether apoptosis was induced by the combination treatment by measuring for caspase 3/7 activity. Harnessing the potential of antioxidants as natural, therapeutic remedies is critical for minimizing the adverse effects of chemotherapy.


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 Acne Ingredients on C. elegans

Nafew Rahman, Mamona Raja

Research shows that 85% of adolescents regularly suffer from Acne vulgaris, making skincare an incredibly lucrative business. Brands such as Proactiv and Acutane bring in millions, if not billions, in revenue each year. The ingredients in these big brands are often unnatural chemicals which many have expressed doubts about. These chemicals, namely benzoyl peroxide, salicylic acid, and glycolic acid, are the test subjects of the experiment. To gauge any possible negative effects on human beings, the effects the three chemicals on Caenorhabditis elegans have been recorded. The experimenters hope to educate those affected by acne on what they’re buying to treat the sensitive skin on their faces. The C. elegans were first split into four groups and placed in petri dishes. A drop of Salicylic Acid was put on the C. elegans in one group and the subject was observed under a microscope. While under the microscope a timer was on testing how long it would take the C. elegans to die. This process was repeated with the Glycolic Acid, Benzoyl Peroxide, and water. The results showed that the group under the influence of Salicylic Acid died the fastest, within 20 seconds. The Glycolic Acid group died the second fastest within 40 seconds. The group with Benzoyl Peroxide and Water did not die. Future trials will continue to take place to measure accuracy of results. Errors occurred such as death of worms due to weather and closure of schools.


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 Survey of Handwashing Efficiency
Meybelin Galdamez, Kassandra Rosas

There are over 70 trillion kinds of germs, and a large percentage of them can be found on an individual's hand. Although hand hygiene is essential, it is often not prioritized in daily routines.

The purpose of this experiment was to make people prioritize hand hygiene in their everyday schedule. Thirty individuals were observed twice a week, a total of five times, based on their hand washing skills. Research subjects were tested on whether their hand washing routine improved or not. The efficiency of their skills was rated on a 1-5 scale, 1 being poor and 5 being the best which was determined by the amount of glo germ that remained on their hands. Recipients were given a milliliter of germ stimulated lotion and observed under the UV light for before and after results. Forty percent of the recipients improved their hand washing techniques, while the remaining sixty percent remained consistent throughout the experiment. Although it was predicted that the individuals skills would improve, over half of the recipients did not which rejects the experimental hypothesis. Future research should look at how long it would take participants to have the correct hand washing techniques in their routines.


Ghezeljeh, T., Abbasnejad, Z., & Rafii, F. 2015. 'Effect of a multimodal training program and traditional lecture method on nurses' hand hygiene knowledge, belief, and practice' American Journal of Infection Control

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 Inversion Induced Climatic Factors and Asthma Prevalence
Malia Sample

In the past three decades, the number of people diagnosed with asthma has increased dramatically. This inexplicable phenomenon is concerning because, when irritated, asthmatic’s airways become inflamed, swell and narrow, and produce extra mucus, making it difficult, or even impossible, to breathe. Previous research has attempted to understand and explain this increase but has fallen short. If research can identify a causing or correlating factor for asthma, then doctors and scientists can better treat and prevent asthma. In this experiment, past climate and weather patterns are studied and analyzed in the attempt to find a correlation between them and an increased prevalence of asthma. Inversions have direct correlation with increased humidity which can negatively affect air quality. Based on past research and recent data, it is hypothesized that cities with more and longer inversions will have a higher prevalence of asthma. Weather and medical sites, including Weather Underground and the Centers for Disease Control and Prevention (CDC), will be used to access data regarding the weather and climate of nearly 500 American cities as well as the amount of people diagnosed with asthma. The data will then be analyzed in an attempt to identify trends and correlations between inversions and increased asthma prevalence.

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 - 2018

**The Effect of NSAIDs on the Heart Rate (bpm) of Daphnia magna**

**Samhitha Mada, Dhara Shukla**

The purpose of this experiment is to test which nonsteroidal anti-inflammatory drug (NSAID) poses the greatest risk on the heart to provide a safer alternative for patients prone to heart failure. NSAIDs work similarly to corticosteroids without added side effects and are commonly used for prolonged periods of time, especially in arthritic patients, which can weaken the heart and increase heart rate to the point of heart attack. The effect of Advil, Aleve and Diclofenac (independent variable) was tested on the average heart rate (bpm) (dependent variable) of *Daphnia magna*, and compared to those administered tap water (control). The daphnia were placed in a tap water and corresponding NSAID solution, heart rate was measured. The average heart rate of daphnia administered Diclofenac, Aleve, Advil, and control was 146 bpm, 187 bpm, 169 bpm, 112 bpm respectively. An ANOVA test revealed the data was statistically significant ($p < 0.0001$). The alternative hypothesis, “if daphnia are administered Aleve, then their heart rates will significantly increase”, was supported. The results showed Aleve had the greatest effect on the heart rate i.e. riskiest NSAID to use for a prolonged period of time and Diclofenac is the safest. Some daphnia did not show effects of the medication on the heart until they were out of solution for more than two minutes, which may have affected the data. The next step of this research is to formulate a medication to use with NSAIDs or create extended release NSAID pills to lessen the effect on the heart.


---

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 - 2018**

<table>
<thead>
<tr>
<th>Mutagenicity and Carcinogenicity of Artificial Turf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leah Sibay</td>
</tr>
</tbody>
</table>

The safety and health risks surrounding the use of artificial turf is something that is currently being investigated. Since there are several carcinogenic substances in rubber infill (such as benzo (a) pyrene and (h) anthracene), as well as neurotoxins and potential endocrine disruptors, there is a need for extensive testing of the safety of turf fields (Watterson). Although previous studies conducted by the EPA have displayed no correlation between exposure to turf fields and negative health consequences, the research was not conclusive and the EPA has launched a Federal Research Action Plan on Recycled Tire Crumb Used on Playing fields and Playgrounds to more adequately assess the risks posed by the tire crumbs in turf (Federal...). This experiment investigated the potential carcinogenicity and mutagenicity of artificial turf. An Ames test was conducted. The Ames test utilizes strains of bacteria that are unable to produce the amino acids necessary for their survival on their own to display mutagenicity. High numbers of proliferating bacteria colonies in the Ames test indicates high levels of mutation (Ames MPF). The results of this test yielded a high p-value when the data was analyzed with a t-test, but the large variance in the data necessitates further research. This experiment continued in measuring this substance effect on *Drosophila melanogaster*, where the groups were living in a vial with artificial turf mixed into the *Drosophila* culture media. Data is still being collect on this portion of the 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).
Anesthesia Recovery Rate in Drosophila melanogaster via Chromotherapy
Connor Smith

The field of chromotherapy research is expansive as researchers seek to better understand on how various wavelengths of light affect organisms on a neural, genetic, and physiological level. Previous research demonstrates that, on a psychological and physiological level, light therapy may increase muscle tone or blood pressure, stimulate autonomic nervous system arousal, treat addictions, and even help overcome eating disorders.

The purpose of this research was to discern the effects of light therapy of varying wavelengths on *Drosophila melanogaster*. *Drosophila melanogaster* were subjected to light therapy of different wavelengths and were later anesthetized. The time it took for each organism to regain consciousness after anesthetization was recorded. Statistical analysis via t-tests indicated that the null hypothesis, that differing light colors would play no significant role in the speed at which *Drosophila melanogaster* regain consciousness after anesthetization, was refuted. The difference in recovery times of each experimental group was statistically significant enough to suggest that light therapy affects the rate at which *Drosophila melanogaster* regains consciousness after anesthetization. Blue light demonstrated the most profound effect on *Drosophila melanogaster* as they experienced the lowest rate of recovery after anesthetization.

Continued research regarding chromotherapy could enhance the discovery of useful applications especially in the realm of medicine with a focus on neurobiology. Perhaps chromotherapy could alleviate adverse effects of individuals under anesthesia after surgery. The study of neural systems in fruit flies and in humans is extremely intricate, compelling, yet untapped.


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 an Antibody-Chitosan Bio Gel on Ulcer Medication Delivery
Mitesh Shrestha, Deven Upadhyay

Despite medical advances, peptic ulcer disease is still a colossal harm to one of the body’s most essential and complex organs: the stomach. The parietal cells in the stomach’s mucosa secrete hydrochloric acid into the stomach for the purpose of breaking down food along with other enzymes. This gastric mucus membrane is usually enough to protect from the acid, but such protection isn’t always optimal. Contrary to common opinion, H.Pylori bacteria can develop in the stomach environment, disrupting proper function and creating lesions susceptible to acidic damage (Fashner & Gitu, 2015). Peptic ulcers ultimately form as a result of this H.Pylori infection; sores form on the inside of the stomach’s lining (Bianchi et. al 2010). Although most current treatments are widely available, they fail to efficiently promote healing in affected regions. Sucralfate, a sucrose sulfate-aluminum complex, is a medication that coats over ulcers to protect the stomach lining and foster growth (Huang & Sridhar, 2002). Furthermore, its effectiveness is not ideal as localization remains an inherent challenge (G.I.S.U, 1994). Sucralfate will be optimized to treat peptic ulcer disease by enhancing its localization through the means of a smart biogel. The biogel will be composed of chitosan cross-linked with an anti-hydrogen-potassium ATPase antibody. Chitosan, known to work synergistically with sucralfate (Yao, 2012) has been empirically proven to drug-delivery increase to 70% from 35% as compared to a control lacking chitosan microspheres (Jameela,1998). The antibody is known to inhibit gastric acid secretion, which would allow the sucralfate to better perform its duty (Shin et. al 2009). Using a bovine stomach as a base, goat stomach will be inserted into its frame and then submerged into an acidic (2.0 HCl) environment. The bovine (host) stomach will be coated in the bio gel and the goat (foreign) stomach will not; given the bovine stomach is not deteriorated, the bio gel is deemed effective. The mass and depth of the experimental stomach model will be compared to a control version without bio gel lathering.


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).
Dissolving Blood Clots: Investigating Vitamin A in a Porcine Models
Sahithi Vemula

Blood clots can needlessly form in veins and arteries due to overstimulated clotting factors in the body. These clots can cause deep vein thrombosis, myocardial infarctions, pulmonary emboli, and cerebrovascular accidents, conditions that require extensive medical care. Blood clots are currently treated by surgical maneuvers, which are extremely expensive, and tissue plasminogen activator (tPA), which has a limited range of administration from when symptoms first arise and can cause brain hemorrhages and swelling. Vitamin A, correlated with disintegrating fibrinogen (a critical protein in the coagulation cascade), is an antioxidant that also fights cholesterol and inflammation. It was hypothesized that the application of Vitamin A would result in a decrease in well turbidity, an indication of thrombolysis. In the present study, varying concentrations of Vitamin A were tested in porcine fibrin clots, and the optimal concentration for decreasing turbidity was identified. The raw data was not statistically significant between trials with a Kruskal-Wallis or ANOVA test, indicating that the data could be pooled into the 2-factor ANOVA test. A Western blot assay will be performed to determine if a decrease in fibrinogen is present with the Vitamin A treatment. These results will demonstrate when and where certain steps in the coagulation cascade are halted, furthering the current depth of knowledge by offering a possible molecular explanation for the mechanism by which Vitamin A prevents clot formation and induces clot dissolution.


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 Stress has on the Digestive System of Fruit Flies

Alexander Wertz

Stress is a factor that affects the lives of most living organisms. Of concern is the effect stress plays on the digestive system, more specifically, the digestion of glucose. Glucose is responsible for the production of ATP, the major source of the body’s energy. Hence, stress may affect the amount of energy an organism produces.

The purpose of this research was to determine how much of an affect stress had on the Drosophila melanogaster production of ATP and the digestion of glucose. If more glucose is digested, more ATP will be produced, and the organism will have more energy. This was tested by feeding flies different concentrations of glucose, stressing them via centrifugation and then assaying 7 days later to determine the amount of glucose not metabolized. Glucose concentrations were compared between non-stressed and stressed groups exposed to no glucose, 10%, 50%, and 90% glucose.

Statistical analysis conducted via t-test indicated that the null hypothesis was refuted. Stressed flies digested less glucose and appeared more sluggish than did non-stressed flies that digested more glucose and appeared more active. Hence, stress does play a role in digestion of glucose. Further research would entail additional trials employing a wider range of glucose concentrations. In addition, other organisms may be tested to determine whether differences exist in glucose metabolism in them. Worldwide, people and organisms live in environments with high levels of stress and it is important to decrease stress.


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).
# 2018 LCPS Regional Science Engineering Fair

## Biomedical Engineering (500)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>501T12</td>
<td>Bowman, Caitlin King, Christopher</td>
<td>Effect of Changing Heel Height on the Incidence of Dead Spot Phenomenon in Prosthetic Feet</td>
</tr>
<tr>
<td>502T12</td>
<td>Cordova Carrion, Ariana Flaherty, Erin</td>
<td>Decellularized Colocasia esculenta as a Perfusable Bone Engineering Scaffold</td>
</tr>
<tr>
<td>503X12</td>
<td>Khairul Esyani, Haikal</td>
<td>Utilization of Soft Robotics on Peroneal Nerve Injury</td>
</tr>
<tr>
<td>504X12</td>
<td>Khalif, Faduma</td>
<td>Utilizing Varying Wavelengths of Light to Investigate their Impact on β-Amyloid Plaque Growth</td>
</tr>
<tr>
<td>505X12</td>
<td>Krishnan, Santosh</td>
<td>Reducing the Impact Force and Energy Dissipated by the Brain by Using an NS Honeycomb Structure</td>
</tr>
<tr>
<td>506X12</td>
<td>Martin, Brittney</td>
<td>Automated Suturing Device</td>
</tr>
<tr>
<td>507T12</td>
<td>Paulus, Samantha Wright, Trinity</td>
<td>Effect of Decellularization On Assorted Plant Leaves To Create A Pseudo-Vascular Tissue</td>
</tr>
</tbody>
</table>

Category Student Count: 10
### LCPS RSEF OFFICIAL ABSTRACT - 2018

**Effect of Changing Heel Height on the Incidence of Dead Spot Phenomenon in Prosthetic Feet**  
Caitlin Bowman, Christopher King

Prosthetic feet have evolved and made significant strides in the past few decades; however, as prosthetic technology progresses further, even delving into the fields of robotics and neurotechnology, there is still a major mechanical flaw to the design of prosthetic feet - Dead Spot Phenomenon. Dead Spot Phenomenon (DSP) is a period of limited motion during the stance phase of amputee gait during which the prosthetic foot is neither yielding or returning energy to the user; many amputees describe this phenomenon as a “flat spot” or “stall” in the foot and as a feeling of having to ‘climb over the prosthetic foot,” that can over time result in later health problems for the wearer due to use of incorrect muscle groups or dealignment from compensation elsewhere in the body. Due to a lack of research on effect of heel height on DSP in artificial feet, this experiment will investigate whether or not a correlation exists between heel height and incidence of DSP. It is thought that increasing heel height will decrease the incidence of DSP, until a maximum point is reached, which was seen in several studies that showed the lessening of work done in women who wore shorter high heels, but created more work for the hamstrings when the heel was too high. DSP was simulated in a volunteer who has a normal gait cycle by bracing the ankle, and wearing a modified shoe, which created a break in the step that mimics a dead spot. The volunteer then walked across a board which had force plates underneath it, where his center of mass was monitored as a function of time in order to see how the transfer of weight and smoothness of the rollover of the step changed as heel height was added. Compared to when no additional heel height is added, the Dead Spot is further forward on the foot, and the rollover is smoother; however, the dead spot was not shown to begin to move back on the foot and the rollover to be less smooth at greater heights. This partially supports the hypothesis that increasing heel height will begin to decrease DSP; more testing will need to be done to determine the optimal heel height under given circumstances, and to reinforce how increasing heel height can help reduce the ill-effects caused by the dead spot in prosthetic feet.


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).
Decellularized Colocasia esculenta as a Perfusable Bone Engineering Scaffold

Ariana Cordova Carrion, Erin Flaherty

Bones are rigid body tissues that make up exoskeletons and are an essential structure to human life, they provide stability, support for mechanical actions, protect soft tissues and organs as well as serve a blood forming system. Bones can be permanently broken and cannot be easily regenerated. Thus, when bone diseases such as osteoporosis, arthritis, etc. weaken the bones; making their performance frail and/or cause deterioration, there is no solution. This applies to fractures and shattered bones as well. With inspiration from the Worcester Polytechnic Institute; who have made heart tissue from spinach leaves, we have attempted to create an organic scaffold out of *Colocasia esculenta*’s stem and cultured it with *Sporosarcina pasteurii* (a microorganism that can produce calcite precipitation). To determine the effectiveness of our experiment, the presence of calcium carbonate was assessed by visual observation, using a microscope. The durability of the bone was measured by applying pressure by different amounts of weight.


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).
Utilization of Soft Robotics on Peroneal Nerve Injury
Haikal Khairul ESYANI

The science of soft robotics employs robots that are composed of highly compliant materials that are similarly found in living organisms and mimic their movements as accurately as possible. Actuators, commonly used in soft robotics, are pneumatically controlled and incorporate pressurization of air. Also called McKibben muscles, they translate radial expansion into linear contraction.

The goal of this research was to engineer a soft robotic brace for patients with peroneal nerve injury which prevents upward foot movement at the ankle. Such phenomena often occur in individuals who have experienced strokes. This is termed "drop foot." In addition, a rubber brace was molded and attached to this actuator. The brace was tested using an air compressor and an air regulator set to 40 psi.

Brace results yielded an 18% contraction length compared to the initial length of the actuator. This outcome did not satisfy the expected percentage of 20% despite being significantly close. This higher contraction led to steeper net angle change which resulted in the foot being moved higher than necessary. To modify contraction strength, the inner diameter of the muscle needs to be larger to allow greater expansion, thus leading to increased linear contraction. Further research would require testing actuators with larger inner diameters. Ultimately, the use soft robotics using highly compliant materials that mimics human movements may be used in muscle rehabilitation and prevent falls and broken hips results from peroneal nerve injuries.


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).
Utilizing Varying Wavelengths of Light to Investigate their Impact on β-Amyloid Plaque Growth

Faduma Khalif

Evidence exists that a lack of gamma oscillations, a type of brainwave which generally has a frequency of 40 Hz and is thought to have a role in inhibiting the progression of neurodegenerative illness, may be a contributing factor to the onset of many neurodegenerative illnesses, including Alzheimer's (Iaccarino et al., 2016). Therefore, it was hypothesized that if IMR-32 cells, a neuroblastoma cell line which models Alzheimer's, are exposed to high frequency light and/or ultrasonic waves, the amount of β-amyloid plaque produced by the cells will decrease. Moreover, a greater magnitude frequency of light should be able to elicit a response similar to previous research. The cells were treated, then dyed with Thioflavin S dye and imaged to calculate the area of the β-amyloid plaque, which is being used as a hallmark of Alzheimer's. A Kruskal-Wallis test and one-way ANOVA test are the two primary statistical tests used to analyze the data collected. Statistical analysis conducted thus far point to light treatment causing a significant decrease in β-amyloid plaque production with p-values for the 405 and 450 nm light treatments rendering no significant difference between the varying lasers but suggesting a significant difference in β-amyloid plaque production between the treated and untreated cells.


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).
Reducing the Impact Force and Energy Dissipated by the Brain by Using an NS Honeycomb Structure
Santosh Krishnan

As a consequence of repetitive head trauma due to insufficient protection, many athletes and military personnel constantly suffer from concussions and brain trauma. Brain trauma is caused as a result in the acceleration of the brain, and since the brain resists the motion due to inertia, the brain elongates, resulting in brain deformation. Many consequences of brain deformation include chronic traumatic encephalopathy, which is a degenerative brain disorder that causes the protein Tau to clump together and kill brain cells. To negate these problems, many helmet designs have been created to reduce the impact force reducing brain acceleration, but to no avail. However, in 2015, the University of Texas at Austin developed a new structure known as the negative stiffening, or NS, honeycomb. This structure was unique because of its compression abilities, as it could “rebound” from a force after absorbing it. This would reduce the amount of force that reaches the brain because the structure deforms when enacted by a force, but then returns to its normal state. The effectiveness of the structure will be tested by using an impact sensor that will record the acceleration and velocity of a head object, which can then be calculated into force. Then I will compare the percent of force absorbed and efficiency of both helmet designs to see which design is better. This would be a major improvement in helmet technology because it removes the ability for the head to move as a result of the structures bending towards the head, forcing the head to stay in place while the force is dissipated by the honeycomb structure. As a result, the brain is less likely or will experience a smaller amount of acceleration. One major hindrance to the implementation is the cost-effectiveness of the cell. The experimentation done at UT Austin involved laser-sintering nylon printed material. Such technology makes it very difficult for implementation because many organizations look to produce safety measures at lower costs. By using regular 3D-printing technology and polylactic acid (PLA) filament, the goal is to produce an effective device reducing the impact force in simulated collisions in the cheapest possible manner.


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>Automated Suturing Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brittney Martin</td>
</tr>
</tbody>
</table>

While technology is constantly improving and new forms of wound closure are being created, suturing remains the most safe and effective method. While skin glue and staples have the advantage of a more rapid implementation, they often cause more tissue damage and are not as effective at keeping the wound shut, allowing it to properly heal. In order to promote safe and effective wound closure, the use of an Automated Stitching Device would allow for proper wound closure with minimal tissue damage.

In order to create this device, a combination of various materials were used. The production of the prototype consisted of 3D printed materials designed on a computer program, 2 small motors used to power gears, and a single-board microcontrollers board to control the speed in which the needle rotated. The primary use for this device is to implant running cuticular sutures with minimal aid from medical professionals. This device will be tested by its ability to place consistent sutures on a silicon model. Data pending.

The project could be extended by adding a line sensor to the device to allow the inner cube in which the needle is held, to follow the path of the wound. The use of a fully independent automated stitching device would allow medical professionals to focus their attention on patients facing more severe medical emergencies, as well as have potential uses in veterinary and battlefield medicine.


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).
Effect of Decellularization On Assorted Plant Leaves To Create A Pseudo-Vascular Tissue
Samantha Paulus, Trinity Wright

The purpose of this experiment is to find the most viable plant vascular system that facilitates “blood” flow and mimics the human vascular system. The inability to create functional vascular tissue ready to be transplanted into human skin is a major issue, as there is a great demand for tissue which is difficult, expensive, and time consuming to manufacture. Decellularizing different leaf types, including Brassica rapa subsp. pekinensis (Napa Cabbage), Brassica oleracea var. Sabellica (Kale), with Spinacia oleracea (Spinach) as the control, leaves their extracellular structure and makes them more receptive to human cellular material. A synthetic blood was perfused through the midrib of each leaf and the distance traveled and rate of blood flow was recorded. The Napa Cabbage provided the fastest “blood flow” with the Spinach leaves following and Kale exhibiting the slowest flow. The data was analyzed with a T-Test for blood flow rate and a Chi-Square to compare the effects of decellularization. The hypothesis was if different leaf types were decellularized, then they would be able to act as a pseudovascular system and allow different efficiencies of fluid flow. The types of leaves that were decellularized affect the hypothesized rate of blood flow, with the Cabbage being most efficient and Kale the least. Further research could include investigation into viable natural vascular systems other than leaves that also emulate human systems. Some previous studies have also proposed the possibility of introducing human cells to the decellularized structure, to see if they would accept the new foundation.


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).
## Cellular & Molecular Biology (600)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>601X12</td>
<td>Alcantara, Lea</td>
<td>Kale and Lettuce Protoplast Fusion</td>
</tr>
<tr>
<td>602T12</td>
<td>Desai, Shaalini</td>
<td>The Effect of Serotonin (g) on Telomere Length (bp): a Contribution to Personalized Treatments for Hormonal Conditions</td>
</tr>
<tr>
<td></td>
<td>Kalluru, Mridula</td>
<td></td>
</tr>
<tr>
<td>603X12</td>
<td>Greenman, Lucy</td>
<td>Preventing Preterm Birth: Maximizing GSH Synthesis to Fight Oxidative Stress</td>
</tr>
<tr>
<td>604X12</td>
<td>Lee, Hannah</td>
<td>Investigating Vitamin C on the Effect of Insulin-Like Growth Factor I (IGF-I) Expression in Skeletal Muscles</td>
</tr>
<tr>
<td>605X12</td>
<td>Mangan, Shea</td>
<td>Behavior Responses to Light Wavelengths of Rhodopsin Gene Mutants in Drosophila melanogaster</td>
</tr>
<tr>
<td>606X12</td>
<td>Saljuki, Saba</td>
<td>Epigenetic Influence of Light Color on Pigment Deposition in Vanessa cardui (Painted Lady Butterfly)</td>
</tr>
</tbody>
</table>

Category Student Count: 7
**Kale and Lettuce Protoplast Fusion**

**Lea Alcantara**

This project is centered around protoplasts. Protoplasts are cells that lack cell walls after they have been digested by different enzymes, like cellulase and pectinase. Cellulase breaks down cellulose, and pectinase breaks down pectin in the cell wall. Protoplasts can be fused together in a process called somatic fusion through chemofusion or electrofusion. The aim of this project was to fuse kale and lettuce to form a “kalettuce” hybrid. As a result, the healthy qualities of kale can combine with the taste and texture of lettuce. The procedure began with protoplast isolation by using cellulase and pectinase to break down the cell walls. The next step was protoplast fusion with the use of a high pH and high Ca+ solution. A callus will form when put under stress in a centrifuge machine. The callus will be placed in a phytoagar dish with growth hormones, kinetin and gibberellic acid, to aid the callus to grow into the “kalettuce” hybrid.


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 Serotonin (g) on Telomere Length (bp): a Contribution to Personalized Treatments for Hormonal Conditions

Shaalini Desai, Mridula Kalluru

Depression is the leading mental illness in America, affecting around 16 million adults each year. Main treatments include medication or psychological therapy. However, discoveries about telomeres has led to research on personalized alternatives. Telomeres are the end regions of chromosomes that prevent genetic information from being lost, shortening as organisms age. Other factors affect telomere length, including stress, but the relationship between antidepressants and telomere length is unknown. This experiment tested the effect of serotonin (independent variable), an antidepressant, on telomere length (dependent variable). The alternative hypothesis states that if levels of serotonin are lower, then the length of the telomeres will be shorter.

Acheta domesticus (house crickets) were used in this experiment, as insects exhibit genetic similarities to humans. 0.06, 0.05, 0.04, and 0 (control) grams of serotonin-inducing supplement were injected into 10 crickets each. DNA was extracted from each cricket and frozen for future analysis. The real-life implication of this research would be personalizing treatments for diseases affected by hormonal changes, such as Cushing syndrome and depression. By identifying serotonin’s effect on telomere length, scientists can begin to look at treatments that manipulate telomeres in the same manner antidepressants do. Also, this research aims to provide a method to reverse the damaging effect of cortisol on telomeres that is produced by these conditions. Research is still ongoing due to financial, resource, and time limitations. Further research will be conducted to analyze the frozen DNA through quantitative PCR and gel electrophoresis to identify telomere length.


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).
Preventing Preterm Birth: Maximizing GSH Synthesis to Fight Oxidative Stress
Lucy Greenman

Nearly one in eight deliveries in the United States are preterm. Preterm birth has been correlated with oxidative stress, damage caused to cells by free radicals, in the uterine myometrium. Oxidative stress is counteracted by the donation of electrons by antioxidants, among which the most potent is reduced glutathione (GSH). This experiment tests the effect either the maqui berry (0.0125 g/L, 0.1875 g/L, and 0.375 g/L) or cysteine (0.0025 g/L, 0.02 g/L, 0.0375 g/L) on the level of intracellular GSH in uterine myometrial cells. Cells were cultured in RPMI with 15% FBS by volume, stressed through subculture into media containing 10% ethanol, and treated with maqui and cysteine. Two control groups were tested: untreated/unstressed cells and untreated/stressed cells. The presence of GSH was measured via violet fluorescence assay. A Kruskal-Wallis test showed that the highest concentration of cysteine raised GSH levels significantly, while the maqui berry was not shown to significantly increase GSH levels. To help explain these results, RT-PCR is being conducted to quantify the levels of glutathione synthetase and glutathione S-transferase, two enzymes involved in the synthesis and function of GSH. This will help to determine the applicability of maqui berry as a GSH-promoting agent. Supplementation with cysteine is demonstrated to be a feasible treatment for raising GSH levels, counteracting oxidative stress, and preventing preterm birth.


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 - 2018

**Investigating Vitamin C on the Effect of Insulin-Like Growth Factor I (IGF-I) Expression in Skeletal Muscles**  
Hannah Lee

Athletes and people of all ages suffer from muscle injuries such as ACL and rotator cuff tears. Recovery time is long and the muscle is more susceptible to future injury. Last year, insulin-like growth factor I (IGF-I), a hormone that promotes growth, was used and found successful in decreasing recovery time of in vitro muscle injury. However, IGF-I is not easily accessible and expensive.

Vitamin C is associated with the growth and repair of tissue, essential for the synthesis of collagen in a human body and very accessible. Prior research indicates that higher intake of citrus was correlated with an increase of IGF-I, decreasing the risk of chronic disease such as cancer and cardiovascular diseases. In this research, different concentrations of vitamin C applied to C2C12 mouse myoblast cells were analyzed to assess IGF-I gene expression as an alternative to direct IGF-1 supplementation. The fold difference, shows upregulation of IGF-I expression with vitamin C application; repeated trials are still ongoing. This research could provide an easily accessible and cheaper solution to IGF-I and be the solution to reduce recovery time in muscle tears.


---

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).
Behavior Responses to Light Wavelengths of Rhodopsin Gene Mutants in Drosophila melanogaster

Shea Mangan

Autosomal Dominant Retinitis Pigmentosa (ADRP) is a genetic disease that leads to the death of rod cells in the retina, loss of vision, and eventual blindness. Some of the most prominent causes of ADRP are mutations in genes that produce rhodopsin, an important protein in the phototransduction cascade. Drosophila melanogaster display rhodopsin mutations similar to those that lead to ADRP in humans. This project analyzes the behavior of mutant Drosophila melanogaster when exposed to differing wavelengths in the visible light spectrum. Wild type and mutants are tested by placing flies on one side of a two sided chamber with a small hole in the middle divide, exposing a wavelength range on the opposite side, and recording the number of flies that traveled to the light in three hours. It is inferred that since flies have the tendency to move toward light, those that traveled were able to see it, thus having suitable vision. In testing of the wild type as a control, about 25-35% travel in the time period with higher percentages in longer wavelengths and lower percentages in short ones. Significant changes in movement observed from the mutants from alternating wavelengths may indicate potential limitations of the mutant gene to retinal degradation in the flies.

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).
Epigenetic Influence of Light Color on Pigment Deposition in Vanessa cardui (Painted Lady Butterfly)
Saba Saljuki

The environment has an innate ability to influence an organism’s gene expression. Elements such as chemicals, drugs, temperature, and light have been known to change the way certain genes are expressed, possibly leading to alterations in physical appearances. Epigenetics may help to better understand the negative and positive influences that the environment may have on an organism’s genetics.

The purpose this research was to determine whether light had the ability to influence pigment deposition in the wings of butterflies. Vanessa cardui larvae were exposed to white, green, blue, and right light respectively for 24 hours a day for two weeks. The control group received no light for two weeks. Pigment deposition in the wings was recorded through photographs and analyzed via Photoshop. Using statistical analysis, it was determined that light did have an effect on pigment deposition. Butterflies whose larvae developed in blue light displayed significantly more pigment deposition than those who developed with no light. This could possibly be caused by the blue light wavelengths modifying the protein structures bound to the DNA, causing an alteration in gene expression. Exploration of the relationship between light and genetics will further our understanding of how certain lights can genetically predispose not only insects, but humans, to certain traits, behaviors, and, diseases.


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).
# 2018 LCPS Regional Science Engineering Fair

## Chemistry (700)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>701T12</td>
<td>Ballinger, Todd Hughes, Zachary</td>
<td>Extraction of Copper (II) Nitrate From Water Through Electrolysis</td>
</tr>
<tr>
<td>702X12</td>
<td>Hanna, Casey</td>
<td>Enhancing Cellulose Degradation during the Pulping Process via Fenton Chemistry</td>
</tr>
<tr>
<td>703T11</td>
<td>Bora, Zeneida Haque, Melissa</td>
<td>The Concentration of Blue Dyes in Drinks Using Beer’s Law</td>
</tr>
<tr>
<td>704T12</td>
<td>Mathur, Surbhi Wu, Janie</td>
<td>Developing a Low Cost, Non-Invasive Colorimetric Assay to Determine Atherosclerotic Burden</td>
</tr>
</tbody>
</table>

Category Student Count: 7
Water is getting contaminated by heavy metals. High amounts of copper in waterways can be harmful to aquatic organisms. Copper is an essential part for the diets of aquatic life but can be toxic in high amounts. Too much copper can lead to adverse effects on survival, growth, reproduction as well as alterations of brain function, enzyme activity, blood chemistry, and metabolism. Copper is also on the list of “endangered elements”, meaning it is facing supply limitation within the next 100 years. Being able to recover copper from contaminated water sources will help increase the supply of copper as well as protect the aquatic life in contaminated waterways.

Copper (II) nitrate was mixed in a 250 mL solution of distilled water, making four different molarity solutions (0.1M, 0.15M, 0.2M, 0.25M). Each solution was put into a container. Each container had two electrodes hanging into the solutions. One electrode was used as the anode and the other was used as the cathode. The anode was hooked up to a positively charged wire, and the cathode was hooked up to a negatively charged wire. Those two wires were plugged into a 6V power supply. The power supply was turned on and a sample was tested every 10 minutes in a spectrophotometer. The spectrophotometer had a wavelength of 645 nm and was calibrated with distilled water. The spectrophotometer showed the percent absorbance of each sample. Through the process of electrolysis, copper (II) nitrate was removed from the water. The data is pending. The results will be compared to a standard curve to determine how much copper is taken out over time. Other metals that could be tested include silver, nickel and zinc. It can also be useful to preserve these endangered elements.


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 Cellulose Degradation during the Pulping Process via Fenton Chemistry
Casey Hanna

Despite the rising use of recyclables, the global paper industry continues to consume vast energy to meet increasing demands for paper products. Most energy used powers mechanical pulping, which produces a lower quality paper. Chemical pulping, however, uses less energy and results in better quality. Many chemical processes exist to break wood into pulp, however, one overlooked by the industry is the Fenton reaction where oxidizing intermediates cause damage to organic substances such as cellulose.

In this research, the Fenton reaction was employed to assist the pulping process. Cellulose degradation via Fenton chemistry was analyzed by submerging wood chips in Fenton’s reagent of varying concentrations. Initial trials of wood chip samples were subject to a 10% hydrogen peroxide solution with 12.5 milliliters of iron bisglycinate catalyst while a second group of samples was treated with the same concentration of hydrogen peroxide and 25 milliliters of catalyst. A control group consisted of submerged wood chips in water. Reactions were stirred in 7 hour intervals for 48 hours. Chips were drained, dried, and the percent loss in mass was calculated. Statistical analysis via t-test indicated greater significant mass loss in samples treated with the greatest addition of catalyst because the additional catalyst made the reaction run faster, leaving woodchips submerged in cellulose damaging intermediates longer. Further research would entail applying the Fenton reaction to other woods and testing increased catalyst amounts. This will create a cost-effective and efficient pulping process and reduce the amount of energy consumed via industrial process.

The Institute for Industrial Productivity. 2009. Mechanical pulping. Available Online at: http://ietd.iipnetwork.org/content/mechanical-pulping


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 Concentration of Blue Dyes in Drinks Using Beer’s Law
Zeneida Bora, Melissa Haque

Many foods and beverages contain artificial food colors and some countries have put regulations on certain dyes because of their possible dangerous side effects. Brilliant Blue dye is in candies, beverages, baked goods, drugs, dessert powder, cereal, and other products. A lot of people, especially in the United States, drink beverages such as Gatorade, PowerAde, or Kool Aid, due to their taste or even due to their vibrant colors. But what they do not know is the effect of all the dyes in the drink on their body. In this experiment, we tested the concentration of blue dye in beverages many of us drink. We found out the concentration through a colorimeter, which absorbs the wavelength of a sample. With a colorimeter, the result would end up being the wavelength and just that compared to a spectrophotometer which tests the reflection through a sample. Although our hypothesis wasn’t what we thought it would be, since our hypothesis was that if blue drinks were tested, then the Blue Cherry Gatorade (darkest drink) will have the highest concentration of Brilliant Blue Dye #1. We found out the drink that had the bluest dye was Kool Aid Burst with an absorbance of .928. The drink that had the least amount was Glacier Freeze Gatorade with an absorbance of .068. The effect of artificial food colors (AFCs) on child behavior has been studied for more than 35 years, with accumulating evidence from imperfect studies.


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).
Developing a Low Cost, Non-Invasive Colorimetric Assay to Determine Atherosclerotic Burden

Surbhi Mathur, Janie Wu

Atherosclerosis is the primary cause of cardiovascular disease, which is the leading cause of death worldwide. Elevated concentrations of trimethylamine N-oxide (TMAO) in urine indicate severity of atherosclerosis and therefore risk of cardiovascular disease. The objective of this research is to develop an easily accessible risk assessment test for atherosclerosis by utilizing chromogens to colorimetrically quantify hydrogen peroxide, produced in a 1:1 ratio from the reduction of TMAO.

First, TMAO reductase was isolated from cultivated **Shewanella putrefaciens** in Phase 1. Subsequently in Phase 2, three chromogens — 2,2′-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) (ABTS), tetramethylbenzidine (TMB), and guaiacol — were evaluated for colorimetric response to the breakdown reaction of hydrogen peroxide. Chromogens that exhibited a visible response continued to Phase 3. TMAO solutions were created based on patient data, reduced with the isolated TMAO reductase to produce hydrogen peroxide, then dropped onto filter paper strips dipped in chromogen made to simulate dip strips. Pictures of each set were evaluated for percent color and graphed against concentration to determine each chromogen’s ability to respond to TMAO concentration. The chromogens that displayed distinct color changes and high sensitivity to hydrogen peroxide may be utilized in the development of a novel colorimetric assay that would aid early detection of atherosclerosis and prevention of cardiovascular disease. Data is forthcoming and on track to be completely collected by April.


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).
## Computational Biology & Bioinformatics (800)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>801X12</td>
<td>Hall, Luke</td>
<td>Analysis of Influenza Surveillance Data to Predict Vaccine Strains Using Computational Methods</td>
</tr>
<tr>
<td>802X12</td>
<td>Khan, Amina</td>
<td>The Morphological Significance of Dysregulated Gene Expression in Extracellular Matrix Receptor Interaction in Pancreatic Ductal Adenocarcinoma</td>
</tr>
<tr>
<td>803X11</td>
<td>Moore, Madden</td>
<td>Detecting Multiple Cancers Through MicroRNA Biomarkers Through Different Machine Learning Algorithms and Statistical Analysis</td>
</tr>
<tr>
<td>804T12</td>
<td>Rabbani, Ayon Vangaru, Srivatsav</td>
<td>Predicting Biological Symptoms from Protein Binding and Docking Data Using Different PNPO Mutants as a Model</td>
</tr>
<tr>
<td>805T12</td>
<td>Santos, Kayla Tran, Michelle</td>
<td>(Mathematical) Modeling of Horizontal Gene Transfer Resulting in Antibiotic Resistance of Staphylococcus and Bacillus genera</td>
</tr>
<tr>
<td>806X12</td>
<td>Sumathipala, Marissa</td>
<td>Next Generation Drug Discovery: A Novel In Silico Network-Based Approach to miRNA Drug Target Identification</td>
</tr>
</tbody>
</table>

Category Student Count: 8
Analysis of Influenza Surveillance Data to Predict Vaccine Strains Using Computational Methods

Luke Hall

As computer software becomes increasingly advanced, more places are discovered that can utilize code to become more efficient. Developing the influenza vaccine is one of these situations, as currently the process is not automated, and takes away both time and money from the Center for Disease Control and Prevention (CDC). This project aims to provide an efficient, simple, and cost-effective solution to this issue in the form of a computer algorithm that predicts strains of influenza that should be synthesized into the vaccine.

To do this, CDC influenza surveillance data from the 2000 – 2001 year was compiled into a single file be analyzed. A program was created using Python, taking the raw data as input, and outputting three strains of influenza that are most suited to go into the vaccine, based on the data. The algorithm itself consists of roughly 5 steps. First, it receives the raw data as input. Second, it calculates and assigns each possible strain a fitness value, signifying its viability. Next, each strain is tested against each other strain, so that the most suitable one is selected. Then, the program applies other factors, such as repetition, and comparisons to last years data. Finally, the best suited strains are outputted.

After the results of the program were tested against the actual 2000 – 2001 vaccine, it was found that the program printed out the correct strains every time it was run. The program not only showed incredible accuracy but showed statistical significance with a p-value of 0 (Binomial Two Tailed Test). This research could change the way biological processes are analyzed.


Overview of Influenza Surveillance. (2017, October 13). Retrieved February 26, 2018, from https://www.cdc.gov/flu/weekly/overview.htm#Viral

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 Morphological Significance of Dysregulated Gene Expression in Extracellular Matrix Receptor Interaction in Pancreatic Ductal Adenocarcinoma

Amina Khan

Pancreatic ductal adenocarcinoma (PDAC) is a malignant tumor caused by uncontrolled cell growth in the the duct of the exocrine compartment of the pancreas. PDAC is the fourth-leading cause of cancer-related deaths in the world and is rarely detected in early stages due to its rapid metastasis. This study used the dataset GSE28735 from the Gene Expression Omnibus, and focused on differential gene expression between cancerous and same-patient non-cancerous pancreatic tissue (N=45). The dataset was analyzed by GEO2R to determine relevant genes (p-value less than 2.25x10^{-10}, Student's t-test), and the STRING database was used to analyze connections between these genes in pathways. The connections found by the STRING database were compared in order to find related annotations in the Gene Ontology enrichment database.

Genes in the collagen, laminin, fibronectin, and integrin subunit families showed significantly different expression after GEO2R analysis. These gene networks all showed connections to each other in the STRING database under the Gene Ontology term "extracellular matrix receptor interaction" with a false discovery rate of 1.85x10^{-7}, which correlates with their roles as transmembrane proteins and receptors in cell adhesion and migration. These cell adhesion genes are all overexpressed in PDAC, which, coupled with the downregulation of KLKB1, a positive regulator for fibrinolysis and inflammation, may explain the hypovascularized morphogenesis of the tumor and the hypoxic environment it creates. Additional treatment options could be explored using microRNA inhibition of the cell adhesion function based on the discovered biomarkers.


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).
Detecting Multiple Cancers Through MicroRNA Biomarkers Through Different Machine Learning Algorithms and Statistical Analysis
Madden Moore

Random Forests and Neural Networks, two modern machine learning algorithms, are both very good at recognizing patterns in very complex data. MicroRNAs (miRNAs) are non-coding RNAs of about 22 nucleotides in length that post-transcriptionally regulate gene expression. Certain miRNAs have been shown to be significantly over or under expressed in singular cancers, but very little work has been done compiling results of analysis of miRNA expression across multiple cancers. In this study, Random Forests and Neural Networks were used for classification of cancer patients as "tumor" or "normal" based upon microRNA patterns. These models were trained and tested on miRNA expression data from the Genomic Data Commons, an open government database. Methods of analysis included confusion matrices, ROC curves, and DESeq2, as well as traditional parametric statistical analysis. Additionally, lists of high-importance miRNAs towards the development of the random forests were collected for later analysis of consistently significant miRNAs across multiple diseases. Data analysis of these results is still ongoing at this time. This work is important as it may be a key starting point for doing non-invasive testing using microRNAs in exosomes secreted from tumor cells as biomarkers for early cancer detection.


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).
Predicting Biological Symptoms from Protein Binding and Docking Data Using Different PNPO Mutants as a Model
Ayon Rabbani, Srivatsav Vangaru

Vitamin B6 is an important compound that plays a fundamental role in human growth and energy. This vitamin sustains blood sugar levels, gives us extra energy, and creates antibodies for our immune system. Deficiencies in the expected level of in the body can lead to weakness, nerve problems, and mental problems. Pyridoxamine 5’-Phosphate Oxidase (PNPO) is a gene sequence that tells the body how to create the enzyme pyridoxine 5’-phosphate oxidase which metabolizes vitamin B6. The other two active forms of vitamin B6 are pyridoxamine (PM) and pyridoxal (PL) which phosphorylate to PLP. Disregarding dietary vitamin B6 insufficiency, mutations of the PNPO enzymes are critical causes for PLP deficiency. Effects of pathogenic mutations in the PNPO gene can be observed in PLP dependent epilepsy. An example would be Neonatal Epileptic Encephalopathy (NEE), a disorder caused by a missense mutation (r229w) in PNPO, (Musayev et al), which affects proper PNP binding due to an absence of His-227 and Arg-255 (Musayev et al). NEE is one of the most observed mutations, causing babies right after birth, or sometimes before birth, too have seizures. In our project, we will use the wild type PNPO gene sequence and the r229w, as well as other identified mutants as a baseline for comparing other unidentified PNPO mutations. After gathering all the mutations, we generated 3D models and used the coordinates of the PLP to get binding data. From that we know the binding affinity. Then we created a graph from all the mutations with Kcat and binding score to identify whether the problem lies in the docking or the reaction. This data will be used to help identify possible reasons for symptoms in patients with vitamin deficiencies, along with identifying possible 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).
(Mathematical) Modeling of Horizontal Gene Transfer Resulting in Antibiotic Resistance of Staphylococcus and Bacillus genera

Kayla Santos, Michelle Tran

Antibiotic resistance has become a much more prevalent and dangerous aspect of a bacterium’s genome. These antibiotic resistance threats only increase due to bacteria’s ability to transfer their genes to others through horizontal gene transfer (HGT) which spreads their resistance. This experiment will determine which genus, Staphylococcus or Bacillus, is prone to HGT and thus antibiotic resistance within Staphylococcus aureus subsp. aureus USA300_TCH1516 using mathematical modeling.

Genome sequencing is a technique that has made identifying gene transfers possible. Specific programs such as RIATA-HGT and Geneious allow researchers to analyze gene sequences for various results. This project implemented nearHGT which determines the chance that HGT had occurred by simply comparing the genome of two intended species along with two reference species of bacteria.

In this experiment, the effect of HGT on antibiotic resistance of bacitracin, fosfomycin, penicillin, and tetracycline in Staphylococcus and Bacillus genera were compared. The nearHGT program was used to mathematically analyze gene transfer and calculate the chances of HGT by chi-square analysis. NearHGT determined a significant chance ($p<0.05$) that HGT had occurred between Staphylococcus aureus subsp. aureus USA300_TCH1516 and Bacillus strains in the presence of fosfomycin. The other antibiotics did not show such a strong correlation. Further research is needed to understand how antibiotic resistance is transferred by HGT and how to detect and prevent antibiotic resistance using knowledge gained by mathematical analysis.


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).
Next Generation Drug Discovery: A Novel In Silico Network-Based Approach to miRNA Drug Target Identification

Marissa Sumathipala

Chronic disease is the leading cause of death in the world. Next generation therapeutics are needed to combat the growing global health crisis of chronic diseases—chiefly cancers, cardiovascular diseases, and endocrine diseases. Discovered less than two decades ago, miRNAs are small non-coding RNAs that regulate gene expression. As key biomolecules controlling disease pathways, miRNAs are promising candidates for innovative therapeutics. Yet, identifying optimal miRNAs specific to a disease remains a challenge.

The current miRNA drug discovery path—tedious in vitro experiments—is time-consuming and expensive. Moreover, it is ineffective, yielding hundreds miRNA candidates per individual disease, many of which are disease-nonspecific. To pinpoint disease-specific miRNA therapeutic candidates, this study creates a novel systemic, computational model of miRNA and diseases. Leveraging massive genomic datasets, the model is a comprehensive, complex miRNA-disease network built in two stages; a miRNA-gene-disease tripartite network is first constructed, and then reduced to a miRNA-disease bipartite network. Key to the model's predictions are the novel statistical inference and community detection algorithms developed.

The model successfully predicted 1-2 optimal miRNA per individual disease, for a total of 101 diseases. Examples include miR-507 for prostate cancer and miR-567 for ovarian cancer. Of the total 190 novel miRNAs identified, 47 were for cancers, 69 for endocrine diseases, 46 for cardiovascular diseases, and 28 for psychiatric diseases.

The miRNA-disease network succeeded in predicting key miRNAs that are highly correlated to a disease, in stark contrast to expensive, tedious experimental methods that yield hundreds of miRNA candidates. This novel in silico network model provides a paradigm shift towards quicker, cheaper miRNA target discovery and clinical translation.


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).
### Earth & Environmental Sciences (900)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>901X12</td>
<td>Beisler, John</td>
<td>Testing the Effects of Various Microplastics on the Fertility of Arbacia punctulate as a Method to Measure Pollution Toxicity</td>
</tr>
<tr>
<td>902T11</td>
<td>Goldbeck, Sophia Nguyen, Christopher</td>
<td>Modeling a New Coral Mucus to Prevent Coral Bleaching: Determining the Resistance of Halomonas halodenitrificans Biofilm Formation to pH</td>
</tr>
<tr>
<td>903X11</td>
<td>Goodrich, Carter</td>
<td>The Relationship Between Electrical Conductivity of Soil and Elevation</td>
</tr>
<tr>
<td>904X12</td>
<td>Huddleston, Jon</td>
<td>Effect of Seagrass on the Acidification of Coral Reefs</td>
</tr>
<tr>
<td>905X12</td>
<td>Levene, Meredith</td>
<td>Plant’s Effect on Air Quality in Coal Firing Environments</td>
</tr>
<tr>
<td>906X12</td>
<td>Magill, Jayne</td>
<td>The Effect of Temporal Fluctuations on Pigment Deposition in Hippodamia convergens (Ladybird Beetle)</td>
</tr>
<tr>
<td>907X12</td>
<td>Mason, Lauren</td>
<td>The Effect of BPA on Fruit Flies</td>
</tr>
<tr>
<td>908T12</td>
<td>Chakka, Vamsi</td>
<td>Measuring the Effect of Different Micro-Plastic Concentrations on Brine Shrimp Artemia Mortality</td>
</tr>
<tr>
<td>909X12</td>
<td>Khan, Saimanga</td>
<td>The Effect of Environmental Pollution on Plant Growth in Loudoun County, VA</td>
</tr>
<tr>
<td>910T12</td>
<td>Panyam, Anoop</td>
<td>Using Genomic Sequencing of Biofilm Bacteria to Assess Water Quality</td>
</tr>
<tr>
<td>911X11</td>
<td>Patel, Sohan</td>
<td>The Effect of Algae Strand on Light Distribution and Growth</td>
</tr>
<tr>
<td>912X12</td>
<td>Porter, Lauren</td>
<td>How Elevation Affects the Magnitude and Frequency of Tornadoes</td>
</tr>
<tr>
<td>913X12</td>
<td>Rizzo, Julia</td>
<td>The Effect of Sunscreen Pollution and rising Temperatures on D. magra</td>
</tr>
<tr>
<td>914X12</td>
<td>Schlitzer, Rebekah</td>
<td>The Differences in Water Quality Throughout Loudoun County</td>
</tr>
<tr>
<td>915T12</td>
<td>Stevens, Carson Thomas, Ashlyn</td>
<td>The Effect of Heavy Metal Pollution on the Health of fish in the Potomac River</td>
</tr>
<tr>
<td>916T12</td>
<td>Iyer, Vikram Thakar, Dhairya</td>
<td>The Effect of Iron Fertilization on Carbon Dioxide Absorption (ppm) by Coccolithophore Algae</td>
</tr>
<tr>
<td>917T12</td>
<td>Pham Tran, David Torres, Ericka</td>
<td>The Effect of Acid Rain on L. terrestris</td>
</tr>
<tr>
<td>918X12</td>
<td>Van Lenten, Alexis</td>
<td>The Effect of Contaminated Runoff on Local Bodies of Water</td>
</tr>
<tr>
<td>919T12</td>
<td>Szabo-Borde, Chance West, Abigail</td>
<td>Construction Sites’ Effect on Freshwater Abstract</td>
</tr>
</tbody>
</table>

Category Student Count: 26
Testing the Effects of Various Microplastics on the Fertility of Arbacia punctulata as a Method to Measure Pollution Toxicity

John Beisler

The decomposition of plastics into microplastics in the ocean has created a bioaccumulation of toxic particles that can clog respiratory and gastric systems of marine life, in addition to leaching unhealthy substances that can harm plankton and larvae (Sussarellu et al., 2016). Microplastics cover millions of km² of ocean. Until effective removal methods are found, switching to less toxic plastics is a beneficial option for the safety of humans and marine life. This project tests the effects of polystyrene and polyethylene microplastics on the fertility of Arbacia punctulata by subjecting sea urchin larvae to microplastics and then counting surviving larvae after a 4-day development period. Previous research on microplastic toxicity has shown that additives including emollients, colorants, and antioxidants used to enhance plastic performance can leach from ingested microplastics and reduce lugworms’ ability to remove pathogenic bacteria and engineer sediments (Browne et al., 2013). Limited research exists on sea urchin embryology and the comparison of external noningestive toxicity from different plastics. Polystyrene and polyethylene were ground and homogenized into microplastics and quantified using SEM imagery. Urchin gametes were fertilized and exposed to the plastics for 96 hours, and then urchin cell stage growth state was quantified. Data collection continues, but if one plastic is less inhibiting to cell development, this finding will support that certain microplastics have different levels of toxicity to sea urchin larvae. Preliminary data suggests that both microplastics are severely toxic to gametes, interfering with fertilization and development, and polystyrene has a higher toxicity level than polyethylene.


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 a New Coral Mucus to Prevent Coral Bleaching: Determining the Resistance of *Halomonas halodenitrificans* Biofilm Formation to pH

Sophia Goldbeck, Christopher Nguyen

Coral bleaching events are projected to skyrocket in the coming years as a result of more acidic and warmer ocean water. During bleaching, coral mucus loses its protective properties, increasing the likelihood of death. Coral mucus contains diverse bacteria, but currently there is not a specific genus that is an obligate symbiont of corals. This experiment’s goal is to determine if a new bacteria, which does not belong to coral’s native microbiota, is capable of forming a biofilm in the changing ocean water conditions. *Halomonas halodenitrificans* was chosen due to its ability to survive in a wider pH range than the existing biota. *H. halodenitrificans* was grown in four different pHs (6.9, 7.8, 8.0, and 8.2) in 96-well plates, and a crystal violet assay was performed to determine if there was a difference in the biofilm formation across the four pHs. Data collection continues, however, should there not be a statistically significant difference between the biofilm formation over the different pHs, then *H. halodenitrificans* may be a viable candidate to seed onto coral in the future to determine if it protects the coral during bleaching events. The bacteria is hypothesized to be able to form a biofilm around the coral or integrate itself into the coral mucus. Adding these bacteria to coral has the potential to decrease the frequency or magnitude of coral bleaching events.


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).
In this project, the possibility of showing a relationship between the electrical conductivity of a soil based on its elevation on a golf course was studied using a cheap and reliable electrical conductivity/total dissolved solids probe. Soil electrical conductivity is an important indicator of plant health and affects nutrient availability, turfgrass growth, soil microorganisms and many other things. To show the relationship of these two factors required the utilization of a probe to show the linear regression of electrical conductivity and height. In this experiment, an elevation chart was constructed showing the electrical conductivity EC (dependent variable) of a sample and the elevation height of where the sample was taken (independent variable). The objective of this study was to show a relationship between EC of a soil and its elevation. The study was carried out on the same hill with the same soil composition to ensure accurate results. The results of this experiment did not support the hypothesis that elevation would influence electrical conductivity of soil. Data indicated there was no relationship between a soil’s electrical conductivity and its height with an R square of 0.0103 and an R of -0.101271137.


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).
Effect of Seagrass on the Acidification of Coral Reefs
Jon Huddleston

Coral reefs provide habitats to marine organisms, protect coastlines, and provide economic income to coastal countries. It is widely accepted that reefs are facing severe degradation due to many factors including heightened levels of acidity from increasing entrapment of carbon dioxide in the ocean. The acidity of the water enables the dissolution of calcium carbonate structures that make up the corals. Seagrass has been shown to remove carbon dioxide from the water, thus reducing acidity. This experiment aims to determine if seagrass, specifically chaetomorpha, can remove enough carbon dioxide to help stabilize the acidity levels in coral reefs. Four tanks were assembled with massed samples of coral and the seagrass. Dry ice was added to three tanks over six to seven hours to allow for saturation of carbon dioxide in the water. The pH was monitored while dry ice was added then continued to be monitored over 72 hours. One tank has a continuous stream of carbon dioxide provided through the aeration system for at least a 24-hour time after initial exposure to dry ice. Comparisons of the changes to pH of the tanks were performed to assess the elevation of pH, thus loss of acid levels due to natural release of carbon dioxide from the water versus carbon dioxide absorbed by the seagrass. The changes to the mass of the coral will indicate the detrimental effects of acid levels. Further research may consider how temperature affects acidity in water and how temperature affects growth of marine organisms like coral.

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).
Plant’s Effect on Air Quality in Coal Firing Environments

Meredith Levene

Plants can remove carbon dioxide from the air through the respiratory cycle by converting it into oxygen. Because carbon dioxide is a major component of greenhouse pollution, plants help to control the amount of carbon dioxide in the air as well as pollution levels. Additionally, coal releases sulfur dioxide, nitrogen oxides, particulate matter, and various volatile organic compounds. My research investigates if plants can help improve air quality specifically near coal burning facilities in urban environments. My research also investigates the effect the coal has on the growth and health of the plants. To test this, six types of plants, including seedlings and fully grown plants, were placed into a test group and exposed to various levels of coal exhaust. The test group exposed to high levels of coal had a high level of browning on the leaves and stems. These plants appeared unhealthy. However, those not exposed to any coal remained healthy and had low levels of browning. Humidity, pressure, and temperature of the air was found constant among the test groups. Data is still being gathered on the air composition of each test group, and the growth and leaf death of the plants. Quantitative data on the growth of the plants will be collected upon the opening of the sealed terrariums.


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 Temporal Fluctuations on Pigment Deposition in Hippodamia convergens (Ladybird Beetle)
Jayne Magill

As climate has changed over many years, global temperatures have increased. Since 1975, global temperatures have increased by 0.15-0.20 °C every decade. Some pigment producing genes are controlled by temperature changes such as those found in the Arctic fox and the Himalayan rabbit. The intent of this research was to determine whether temperature played a role in pigment deposition in other organisms such as insects, particularly *Hippodamia convergens* (ladybugs).

Approximately 100 *Hippodamia convergens* were divided into three temperature-controlled containers. The three containers were held at 16, 24, and 32 °C. Over the course of two weeks, photographs of the ladybugs and the degree of red pigment deposition was analyzed via Adobe Photoshop. Via statistical analysis, it was determined that after the first week, greater pigment deposition occurred in those ladybugs subjected to colder temperatures. The control group exhibited the least amount of pigment deposition. After the second week, the data suggested that those ladybugs subjected to the hot temperature displayed the most pigment deposition. Those subjected to cold temperature lost the greatest percentage of red pigment. From this, it can be concluded that there is some component of their gene that is affected at either extreme temperature. These changes in pigment deposition may affect population numbers particularly when sexual mate selection is based upon a certain physical characteristic. Since earth is experiencing great environmental changes, it is important to look at the minute alterations this may cause.


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 BPA on Fruit Flies

Lauren Mason

Estrogen is very similar to a popular molecule named Bisphenol A (BPA). They both have hexagon shaped rings that make up the body of the molecule and have OH and HO bonded at the ends. Their similar molecular structure can make it difficult for the body to differentiate from each other. In my project, I will be observing fruit flies and how they react to water that has been infused with BPA and their overall death rate. In order to do this, I have soaked pieces of plastic water bottles into 70% of denatured ethanol. It soaked the plastic in the ethanol for 3 weeks. After 3 weeks I evaporated the liquid with the help of boiling it to leave only the BPA. The next step in my project is to infused the BPA into drinkable water for the fruit flies and observe them over the next week or so that they will live. Aside from the death rate I will observe their set characteristics that are special to their species and determine if they change with the presence of BPA.


https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1519121/


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).
Measuring the Effect of Different Micro-Plastic Concentrations on Brine Shrimp Artemia Mortality

Vamsi Chakka, Rithvik Nalla

Plastic pollution has been a major global concern over the past few decades. With this unprecedented increase in plastics, a new problem is arising on how to discard these materials. For example, it was reported in 2015 that more than 5.25 trillion pieces of plastic exist in the ocean, about 269,000 tons of plastic float on the surface of the ocean. The plastic pollution in the ocean is greatly affecting the marine ecosystems. Finding means to minimize plastic pollution is a main goal. However, to understand the toxic effects of microplastics on marine life, experimentation needs to be conducted. Research is currently being conducted where brine shrimp Artemia were divided into four groups and exposed to different microplastic concentrations of one, ten, and twenty percent. Then, random samples were taken periodically to determine the affected brine shrimp populations. The results for this experiment were that the control lost 3.92% of the population, one percent concentration lost 5.61%, ten percent concentration lost 19.38%, and twenty percent concentration lost 34.59% of the population. Experimentation is still 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).
The Effect of Environmental Pollution on Plant Growth in Loudoun County, VA
Saimanga Palnati

Although Loudoun County is deemed to be the richest county in the United States and one of the most technologically advanced, it is still prone to heavy environmental pollution. This is due to the county’s high ozone levels, created by the reaction of sunlight on emissions from vehicles and other sources, according to the American Lung Association, and number of orange days, described as the number of days with highly polluted air. Thus, it is important to measure the county’s current level of pollution and the effect it is having on local plant life. The purpose of this study is to assess the response of plants in the Loudoun County area and their anticipated resistance and tolerance to pollution. In order to do this, the Air Pollution Tolerance Index (APTI) will be calculated. It will be calculated for the plants in the test region and those grown later separately in the test region and store bought soil. The APTI is calculated using the concurrent analysis of four parameters: total chlorophyll (TC) content in leaf extracts, ascorbic acid content, pH, and relative water content (RWC). These four parameters are used to find APTI using the following equation (Noor 2017):

\[
\text{APTI} = \frac{A(T+P)+R}{10}
\]

Where A is ascorbic acid content (mL), T is for TC content (mg/g), P is the pH of leaf extracts, and R is the RWC of the leaf (%).

The hypothesis and expected results of this experiment is that the plants from the test regions that are exposed to pollution affecting the soil will form a greater resistance to this pollution and thus will have a greater APTI. The experiment will be carried out in 4 parts. In the first part, the soil and leaves from the test regions will be collected and separately bought from the store. Next, the soil will be tested and analyzed, measuring the pH and metal contents of the soil. Third, the leaves will be tested and analyzed, measuring the pH, relative water content, ascorbic acid content, and total chlorophyll content. In the fourth part, herbs will be planted in the collected soil sample and plant growth will be observed and analyzed. Then, predictions for future plant growth resistance to pollution in Loudoun County can be made in correlation to the increasing population.


Gaffron, H. (1976). Air Pollution and Plants Responses of Plants to Air Pollution J. Brian Mud

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 Genomic Sequencing of Biofilm Bacteria to Assess Water Quality
Anoop Panyam, Uday Sidhu

Contemporary construction in developmental areas displayed harmful effects on ecological surroundings, primarily in the form of synthetic fertilizer runoff and sedimentation. Physical water quality testing procedures have been proven to be cost inefficient and time consuming, resulting in slow testings. The effectiveness of PCR on biofilm samples from various rivers to determine overall health will be evaluated, and ultimately utilized to bypass conventional testing, resulting in the optimization in terms of efficiency of water quality testing. This study is a two-step analysis; the first part was to develop an easier method to extract biofilm DNA. The DNA will then enter phase two of the experiment to see if it can be successfully analyzed to find correlations between DNA sequences and overall health of the river. The first phase was successfully conducted through the qualitative observation of DNA, and the second phase will be conducted by measuring the band length and distance travelled on the Gel Electrophoresis. A combination of enzymes and lysozyme were used to successfully lyse the cell walls of the bacteria and to break the extracellular matrix and lyse the cell, therefore exposing the DNA. The DNA was then purified per a 95% ethanol extraction. Electrophoresis coupled with the chemical testing obtained will theoretically be able to determine and compare the relative quality of healthy and unhealthy rivers. Bands of similar lengths on the healthy rivers and on unhealthy rivers indicated corresponding genomic sequences. Industrial waste and fertilizer runoff contribute to ammonium enrichment. The oxidation of Ammonia is the rate limiting step and is catalyzed by ammonia monooxygenase (AMO), which is ultimately encoded by the amoA gene. Amplification of the amoA gene from water sample indicates nitrification and presence of ammonia oxidizing bacteria (AOB) Broad Run River and school pond were collection sites. Research was coupled with the collection of organisms in rivers alongside various chemical assessments on phosphate, nitrate, alkalinity, pH, and dissolved oxygen levels, in order to vindicate results.


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 Algae Strand on Light Distribution and Growth**

Sohan Patel

One potential sector in renewable energy is algae. Algae, species *Chlamydomonas reinhardtii*, has promising benefits for the future. To understand which strain of *Chlamydomonas reinhardtii* is the most efficient species, two strands of *Chlamydomonas reinhardtii* were tested: the CC-1101 mutant and the CC-125 Wild Type (independent variable). In the study, algae growth was observed to see which strand grows the most and which allows more light to pass through it (dependent variables). For the control, water without algae was used. Three jugs of water were set up and each day the amount of light that passed through was measured with a light sensor. The luminance of the jug containing the CC-125 Wild Type was however, decreasing at a faster rate than the luminance of the CC-1101 mutant. On the first day of the cultivation, the CC-125 wild type and the CC-1101 had an equal measure of luminance. However, on day 7, the last day, the CC-125 had a luminance of 293.3 lux, while the luminance of the CC-1101 had a luminance of 430.4 lux. The alternative hypothesis, if light passes through equal amounts of algae, CC-1101 mutant strain and CC-125 Wild Type, the CC-1101 mutant strain will yield more efficiency due to the fact that it allows more sunlight through, thus yielding more growth, was supported. Further research can stem from this experiment, branching off to experiments on collecting and harnessing energy from algae.


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 - 2018

**How Elevation Affects the Magnitude and Frequency of Tornadoes**  
**Lauren Porter**

This experiment explores how elevation affects the magnitude and frequency of tornadoes. It is hypothesized that elevation greatly affects the magnitude and frequency of tornadoes because of pressure and temperature variations at different elevations. In conducting the experiment, GIS on desktop was used to spatially analyze where the most tornadoes occur in Missouri, Arkansas, North Carolina, and South Carolina. This was compared to where the mountainous regions in these states are located. These specific states were chosen because of the wide range of elevations within them. The results showed that elevation greatly affects the magnitude and frequency of tornadoes, with the highest magnitude tornadoes occurring at the same elevations and concentrated in the same areas. In conclusion, the results proved the hypothesis that elevation greatly affects the magnitude of tornadoes.


---

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 - 2018

The Effect of Sunscreen Pollution and rising Temperatures on *D. magna*

**Julia Rizzo**

The purpose of this research is to see if sunscreen affects *Daphnia magna*’s heart rate and if heat will increase the effects. The *D. magna* serves as a model for fresh water organisms. The project included observing the *D. magna* at various temperatures: 13, 17, 21 and 25 degrees Celsius. The *D. magna* were separated into eight groups, two at each temperature. One group at each temperature had sunscreen, while the other served as the control. The *D. magna* were placed in the various water and exposed to UV light, then transported to a petri dish to be viewed in a microscope to record their heart rate. The study found that the sunscreen does decrease the heart rate. The following control group and experimental group heart rates were calculated: 174, 191.2, 154.8, 204.4 and 126.4, 113.6, 116.4, 128.8. If *D. magna* is exposed to sunscreen in their water, their heart rate will decrease. If *D. magna*’s heart rate is affected by the sunscreen in their water, increased water temperatures will cause greater effects. The first part of the hypothesis was supported by a two way ANOVA test, while the second was not. This means the sunscreen in the water did drop the heart rate of the *D. magna*, but the temperature of the water had no effect. Further research could explore a larger range of temperatures, or looking at respiratory functions instead of heart rate.


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 Differences in Water Quality Throughout Loudoun County
Rebekah Schlitzer

Water pollution is becoming more of a threat to society every day. With different types of waste such as fertilizer (chemical), animal, and metal waste entering streams and rivers, the pollution problem is very prevalent. In Loudoun County, there are different types of environments; the most radically different being rural farmland in Purcellville, and densely populated, industrialized areas such as Dulles and Sterling. These structurally opposite areas contribute to different types of pollution in the county's groundwater.

Data from different water systems across the county, including Goose Creek, Broad Run, and Catoctin, was observed and utilized in arcGIS software. The map created using the software clearly shows the different levels of fertilizer (chemical), animal, and metal waste located in the depicted water systems. The origin of the pollution is relevant and shows that different types of development affects the amount and type of pollution produced. This arcGIS map will prove that areas of industrialization will produce more runoff than rural 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 Effect of Heavy Metal Pollution on the Health of fish in the Potomac River
Carson Stevens, Ashlyn Thomas

Fish floating lifelessly on the surface of the water is unfavorable to see in a lively river. This problem may be caused by pollution in the water. The independent variable was the location the water samples were obtained, the dependent variable was the amount of pollution found in the water, and the control group was the water collected in the back of a clean stream (Pohick Bay). The water from each site was collected 5 feet below the surface using a homemade water collection device. The tests performed were a heavy metal test, pH test, and a dissolved oxygen test. The alternative hypothesis was if there are a large number of dead fish, then water pollution will be high. After analyzing the results, it has been concluded that there was no sign of heavy metals, the dissolved oxygen was at a healthy level, and the pH was very close to neutral. After data analysis, the hypothesis was not supported. Limitations to this research include time of year that water was collected. Further research should explore what other types of pollution could be the cause of fish death.


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 Iron Fertilization on Carbon Dioxide Absorption (ppm) by Coccolithophore Algae

Vikram Iyer, Dhairya Thakar

In order to reduce the effects of human-induced carbon emissions that increase ocean acidification, decimate the atmosphere, and harm marine life, the experiment’s purpose was to research the effect of differing concentrations of (FeNO3)3 (Iron Nitrate) on calcifying Coccolithophore algae in saltwater, to record the level of CO2 absorbed. This experimenters used varying ppm levels of (FeNO3)3 in three different concentrations (independent variable) to measure the level of absorption (dependent variable) with a control that held the algae without the Iron Nitrate solution. The cultured algae and saltwater-soil solution were placed into individual containers, and after Iron Nitrate solutions were added, carbon sensors were used to measure absorption levels of four groups, four times in two days increments over three weeks, and then re-tested using freshly cultured algae and solutions. With averages of 1449.42 (Control) as well as 711.67 ppm (Group A), 453.75 ppm (Group B), and 527 ppm (Group C), an ANOVA test produced a p-value of 0.0001. This data supported the alternative hypothesis: if the concentration of (FeNO3)3 is at a higher concentration then the coccolithophores will absorb more CO2. The independent variable did affect the dependent variable in how the coccolithophores absorbed more CO2 when (FeNO3)3 was involved as opposed to just the algae. The most glaring limitation were the snow days that disrupted the recording process. A question that may further research is whether the pH levels of the water has any impact on the level of absorption.


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 the rise of industrialization, pollution has risen in all forms as well. As a result, acidic rain has become a constant and has affected those in third world countries most, who often use rainwater to drink and bathe in. This project determined how the different pH levels of water affected Lumbricus terrestris and their possible effect on human health. Water with pH levels of 4.5, 5, and 5.5 were tested on L. terrestris and compared to water with a pH level of 7. The pigment of the L. terrestris’ surface altered depending on the pH level of the water it was exposed to. While L. terrestris at a pH level of 7 were red, they grew lighter, and then purple at the lowest pH level. The lower the pH level of the water was, the further the color strayed from its original pigment, indicating a possible effect of acid rain on skin color. If L. terrestris are exposed to acid rain with a pH level of 4.5, then the surface pigment will be the darker than L. terrestris exposed to water of higher pH levels. The hypothesis is supported by the change in pigment on the L. terrestris’ surfaces. When a couple drops of acid rain were added to each worm over the course of two weeks, the color darkened significantly. This shows that human skin can be affected by acid rain in third world countries. Further research could explore how other factors contributed to the change in pigment of the surface, including light.


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 Contaminated Runoff on Local Bodies of Water  
Alexis Van Lenten

Water quality is greatly impacted by natural and human processes. Specifically, the chemical concentrations within the Potomac River are influenced by the waterways and runoff that empty into it. Stormwater runoff is filled with pollutants such as sediment, salt, and fertilizer chemicals. Working against it are the wetlands and wet retention ponds that capture and retain the contaminated runoff. Two waterways that empty into the Potomac are SugarLand Run (an area that experiencing most construction 20 years prior) and Goose Creek (experiencing on going construction even to date). In this experiment, multiple water samples were collected from wetlands and retention ponds, which feed into SugarLand Run and Goose Creek which each latter run into the Potomac. Tests are being conducted to determine the effectiveness of these runoff controls along SugarLand Run and Goose Creek. Does more established wetlands and wet retention ponds. More samples have and will continue to be taken after periods of rain and snow. At this point, p-values are inconclusive, but data is still being collected.


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).
Construction Sites’ Effect on Freshwater Abstract
Chance Szabo-Borde, Abigail West

Does construction harm our environment? Do the fumes and debris harm the quality of various streams surrounding construction sites? We are planning to take samples from 15 different rivers near construction. We will take one sample from fifty yards upstream and another from fifty yards downstream to compare the pH levels, the presence of hydrocarbons, and a variety of other contaminants we may discover.1 This will help us learn about the developments we are making and the impact they have on us that we may not pay attention to. It will make construction workers and landscapers more aware of what they choose to do and where they choose to do it.

Our hypothesis is that the water near construction will be more polluted and have less desirable qualities. That water will most likely not be water you would like to drink, and could be harmful to various wildlife trying to survive in these ecosystems.2

Using different water testing strips such as hydrocarbon strips or pH strips, we plan to check all of the water systems around us that we have access to. We will take samples and record what the testing strips tell us about the water and then compare the ones from downstream, which should be affected by construction, and upstream, which should not be affected.3


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).
## 2018 LCPS Regional Science Engineering Fair

### Embedded Systems (1000) & Mathematics (1600)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001X12</td>
<td>Warner, Corwin</td>
<td>Using Arduino© Microcontrollers for Dual-Fuel Injection</td>
</tr>
<tr>
<td>1601X12</td>
<td>Bartholomew, Nicholas</td>
<td>The Properties and Applications of the Brachistochrone Curve</td>
</tr>
<tr>
<td>1602T11</td>
<td>Angel, Jeremy</td>
<td>Predicting Seizures Using Non-Spiking and Spiking Artificial Neural Networks in Sequence</td>
</tr>
</tbody>
</table>

Category Student Count: 4
Using Arduino© Microcontrollers for Dual-Fuel Injection
Corwin Warner

This project uses a low-cost microcontroller (Mega2560) to act as both a fuel injection controller and an Emissions Control Module in a feedback control configuration for a commercial engine.

Dual-Fuel injection of the ratio of gasoline to propane enables dynamic control of power output and engine efficiency. Combustion of propane yields cleaner production of CO2 and steam, while limiting pollutants normally produced from chemical additives in gasoline.

The Mega2560 was used as the host microcontroller to provide an I2C bus used to automatically control and regulate the gasoline-to-propane fuel-ratio tests. A Hall effect sensor on the inertia dynamometer triggered a hardware-interrupt to report change in revolutions per minute used in power output calculations. Exhaust gas, temperature, humidity, and pressure sensors enabled real-time calculation of change in exhaust pollutants produced during each test.

The Mega2560 microcontroller has sufficient capability to receive data from multiple analog sensor inputs, calculate the delta changes to the system as recorded by the sensors, and adjust the fuel mixture ratio in real-time.

Inaccuracies were observed due to the use of low quality sensors. These problems were directly related to the difficulty calibrating the analog gas sensors resulting in unreliable analysis of exhaust gases produced by each test. Upgrading to a calibrated set of gas sensors would provide accurate readings of exhaust gas composition.

Additionally, the load for the inertia dynamometer is believed to have been too light to provide accurate calculations of power output with various fuel ratio mixtures.

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 Properties and Applications of the Brachistochrone Curve

Nicholas Bartholomew

The Brachistochrone curve, or “least time” curve, was hypothesized by Galileo, to be later solved by Johann Bernoulli. This curve allows for any object to flow from one point, A, to another point, B, in the shortest time with gravity being the only driving factor. However, when this was initially solved, the properties of friction were not present and were therefore not included into the calculations. Furthermore, little has been established, or published, beyond the function modeling the shape due to the presence of friction. The time of descent of the object amongst other properties of the curve was never uncovered. A function of time duration, an approximation of the time minimizing point, the required distance to slow the object at the bottom of the curve, and the construction parameters of the curve were never found or published. The improper integral of change in arc length over velocity was initially used to evaluate the time duration of the object on the curve. This study uncovered the time minimizing point, through the varying of the friction coefficient (μ), approximated to near .2425. The Brachistochrone curve currently remains unused, due to the lack of knowledge on the properties for industrial usage, shipment facilities, or other optimizing solutions, but the properties gathered have the ability to foster new growth and further optimize industrial settings.


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).
Predicting Seizures Using Non-Spiking and Spiking Artificial Neural Networks in Sequence
Jeremy Angel, Matthew Wootten

The problem of seizure prediction from electroencephalograms is a longstanding problem within medicine, as seizures can be mitigated if predicted. While several seizure prediction algorithms exist, they have limitations, such as short timeframes, low sensitivities, or high false positive rates. A model based on a combination of traditional convolutional and spiking neural networks that can separate out preictal (before seizure) segments is presented and evaluated. Spiking neural networks are newer, run more efficiently, and more closely model how the brain learns than traditional networks. The relative effectiveness of spiking neural networks at complicated tasks such as seizure prediction is assessed by using a combination of traditional and spiking networks. Testing the traditional neural network model on a prediction timeframe of 10 minutes shows promising results: a very high sensitivity and accuracy, validating the data processing plan. This model could be used to forecast seizures in surgery, or to create a low-power medical device to automatically suppress seizures.


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).
## 2018 LCPS Regional Science Engineering Fair

### Energy: Chemical (1100)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1101X12</td>
<td>Akalwadi, Siddharth</td>
<td>The Effect of Pressure on the Efficiency of an Algae Photobioreactor</td>
</tr>
<tr>
<td>1102X11</td>
<td>Chandrasekar, Ramprasanna</td>
<td>Effect of Material Composition on Immobilized Yeast Cell Ethanol Production</td>
</tr>
<tr>
<td>1103X12</td>
<td>Dimitri, Brandon</td>
<td>Comparing Various Electrolytes for Optimal H2 Production Via Water Electrolysis</td>
</tr>
<tr>
<td>1104X12</td>
<td>Hillis, Sean</td>
<td>Utilizing Chlorophyll as the Photoactive Agent in a Solar Cell While Using PEDOT:PSS as a Semi-Conductive Substitute for Graphene</td>
</tr>
</tbody>
</table>

Category Student Count: 4
The Effect of Pressure on the Efficiency of an Algae Photobioreactor

Siddharth Akalwadi

With our current energy crisis and climate change issues, there are many alternate sources of energy being explored. However, our transition from fossil fuels to more environmentally friendly energy sources, such as solar power, will be gradual since we cannot rapidly change the current economy. Biofuels can serve as a “stepping stone” towards better sources of energy since many cars that run on fossil fuels can be modified to run on biofuel instead. Biofuels can be extracted from plants, which makes it a carbon neutral energy source. With current technology, algae produces the most biofuel per acre as compared to corn, soybeans, and other plants. However, even with high algal oil yields, the cost of production of biofuel is much higher than that of fossil fuels. The purpose of this project is to examine if increasing pressure within an algae photobioreactor will increase its efficiency. As described by Henry’s Law, the higher pressure will increase the solubility of CO2, and the better availability of the CO2 will allow the algae to undergo photosynthesis and grow faster.

The independent variable is the varying pressures. The control group is 0 psi added, while the levels of pressure used were 5 psi, 10 psi, and 15 psi. The dependent variable was the CO2 concentration inside the reactor, measured in ppm. The assumption made was that if more CO2 is being used at a faster rate, then the algae is undergoing photosynthesis more and is growing better. Each trial was conducted over a span of ten hours with data being collected every ten minutes. The data collection system was two Vernier CO2 sensors connected to an Arduino, which then stores data using an SD card shield. Constants include lighting and temperature. For more reliable results, the trials were conducted in a random order using a simple random sample. Further research can investigate the effect of constant pressurized airflow through the reactor. The composition of the air can be also be modified to mimic industrial sources of carbon dioxide, such as factories or cellular respiration by other organisms.


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).
Effect of Material Composition on Immobilized Yeast Cell Ethanol Production
Ramprasanna Chandrasekar

The fungus, Saccharomyces cerevisiae, is commonly used in fermentation as a source of biofuel. One product of the fermentation process, ethanol, is a comparatively highly efficient biofuel that is considered environmentally friendly and is, therefore, a growing area of interest. The current method of ethanol fermentation is known as “free cell” fermentation and produces moderate quantities of ethanol from Yeast bacterium, though at a high cost, contributing towards its low usage. Due to these inherent costs, a new technique known as cell immobilization was explored previously to potentially increase efficiency. In this technique, yeast cells were encapsulated in a sodium alginate gel. The resulting “bead” yielded higher ethanol production rates, in comparison to free cell fermentation. In a continuation of that prior research, the overarching goal was to research different methods on how to better commercialize the product. The main area of focus was on the material composition of the bead and we compared the rates of ethanol production in calcium alginate beads and in a new alternative, kappa carrageenan beads (K-carrageenan). These tests will what method of cell immobilization is an effective technique to improve ethanol production rates, and can realistically be applied in an industrial setting due to its high durability/permeability. This new insight can be utilized to further research in the field, and to implement safer, cleaner energy consumption strategies.


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).
Hydrogen fuel cells have attracted attention as a renewable and emission free source of energy. Hydrogen is the most abundant element on Earth and can be used to power fuel cells 2.5 times more powerful than internal combustion engines (Hoffmann & Harkin 2014). While hydrogen is so abundant, it is not readily available to use in its elemental form. Electrolysis is a technique which uses an electric current to split water molecules, releasing hydrogen. Other methods of hydrogen production, such as production from biomass or fossil fuels, are cheaper, and therefore more popular, however, carbon emissions are produced from such processes (Godula-Jopek 2015). To achieve larger scale commercialization of emission free hydrogen fuel cells, efficient production of hydrogen is necessary. This experiment sought to compare different electrolytes and electrolyte concentrations in producing hydrogen via water electrolysis to determine the most practical means of producing hydrogen. The solutions tested included NaCl, Na2CO3, KOH, and sea water in 0.5 M, 0.3 M, and 0.1 M concentrations. These solutions were used to fill a graduated cylinder, which was inverted and placed in solution of NaCl. A stainless-steel electrode was positioned in the graduated cylinder as well as an adjacent test tube filled with the electrolyte solution. The electrodes were connected to a 6V battery, and the hydrogen gas produced was measured. Initial results indicated higher electrolyte concentrations produced greater amounts of hydrogen gas. No conclusive data was obtained as to differences between electrolytes in producing hydrogen, but data is still being gathered.


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).
Utilizing Chlorophyll as the Photoactive Agent in a Solar Cell While Using PEDOT:PSS as a Semi-Conductive Substitute for Graphene

Sean Hillis

Chlorophyll, which is found in all photosynthetic organisms, initiates the process of photosynthesis by creating a flow of electrons, which then yields chemical energy that the organism utilizes. This flow of electrons works much like a traditional solar cell, except the photoactive material in a traditional cell is usually a form of silicon, not chlorophyll; however, with the incorporation of chlorophyll as the photoactive material in solar cells, higher efficiency at an area of 5.5 inches by 6 inches - the average area of a commercial and residential solar cell - could be achieved at a lower cost than that of a traditional cell that uses crystalline silicon or polysilicon. As a substitute for graphene, a clear, conductive polymer is used called PEDOT:PSS. This polymer is spin coated at 3000rpm to achieve a thickness of 70nm on a 5.5 by 6 inch glass substrate. This thickness is used to optimize the conductivity of the PEDOT thin film. Once the polymer has dried onto the glass substrate, a prepared chlorophyll extract is then dispersed over the glass plate. To evenly spread out the extract, a 5.5 by 5.5 inch glass plate is placed over top of it, leaving a 5.5 by 0.5 inch space on either side where an aluminum and a copper electrode are placed. The created solar cell is placed under an incandescent light and data is to be measured using a multimeter attached to each electrode. Whether it does or does not produce the desired output of electrical energy, this will increase what is known on organic solar cells.


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: Physical (1200)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1201T12</td>
<td>Drew, Matthew Seymour, Ian</td>
<td>The Effects of Temperature on Battery Storage</td>
</tr>
<tr>
<td>1202T11</td>
<td>Dao, Ngoc-Tram Herrington, Kelly</td>
<td>The Effect of Air Pollution on Solar Panel Efficiency</td>
</tr>
<tr>
<td>1203T12</td>
<td>Moola, Shashank Yachamaneni, Dheeraj</td>
<td>Harvesting Excess Attic Heat to Power a House</td>
</tr>
<tr>
<td>1204T11</td>
<td>Kinney, Spencer Schear, Caleb</td>
<td>Effects of Polarizers on Solid-State Lasers</td>
</tr>
<tr>
<td>1205T11</td>
<td>Li, James Siebor, Konrad</td>
<td>Battling the Heat Island Effect: Improving the Heat Mitigation Properties of Cool Materials Through the Modulation of Surface Geometry</td>
</tr>
</tbody>
</table>
**LCPS RSEF OFFICIAL ABSTRACT - 2018**

**The Effects of Temperature on Battery Storage**  
Matthew Drew, Ian Seymour

Battery storage is imperative to the proper implementation of solar power solutions, so determining the best conditions to store the battery units is vital. The three types of batteries we decided to look at are, Lithium ion, Alkaline, and Nickel metal hydride. Temperature is a major factor in the storage capacity of batteries, so we are testing the batteries in four environments: room temperature, heated, refrigerated, and subzero. We also tested alkaline batteries put together in series at the same environments previously indicated. There is a faster decline in the refrigerated and frozen batteries across all the single battery data, this trend has made itself evident with the lithium ion batteries having an .1V difference between data sets. Both the alkaline and the nickel metal hydride batteries out perform the lithium ion batteries in retaining their charge with more than twice the drop in voltage. The series of alkaline batteries also displays similar trends as the single batteries with colder temperatures having larger voltage drops. While data is still being collected, we have determined that storing Nickel metal hydride batteries stored at a temperature between 70 and 90 degrees fahrenheit will mostly likely be the best candidate for solar battery storage.


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 Air Pollution on Solar Panel Efficiency
Ngoc-Tram Dao, Kelly Herrington

Solar panels are a great alternative energy source but when covered in air pollution, how effective can they really be? This experiment helps show how smoke can affect the amount of energy produced by solar panels. In the experiment, the independent variable is the amount of smoke being produced, the dependent variable is the solar panels efficiency and the control group is the solar panels with no smoke. Solar panels were placed in a cardboard covered fish tank with different levels of smoke being produced. The solar panels were measured, in volts, to see how much energy was produced. The data showed an inverse relationship between the voltage and the levels of smoke. An ANOVA Test was used, and resulted in these means, the control: 7.249 V, one match: 7.183 V, two matches: 7.139 V, three matches: 7.039 and four matches: 6.88 V. The test resulted with a p value of less than 0.0001, meaning the data is extremely significant. The alternative hypothesis is that smoke in the atmosphere will negatively influence the voltage of solar panels, which is supported by these results. Compared to the control group, the experimental groups had a lower average. Some major sources of error are the movement of the sun, buildup on the solar panels and various amounts of ink on the newspaper pages. To further this research, other types of pollution can be tested to see their effect on solar panels.


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).
Harvesting Excess Attic Heat to Power a House  
Shashank Moola, Dheeraj Yachamaneni

<table>
<thead>
<tr>
<th>When air is heated up, it expands. When the air expands, it becomes less dense than the air around it. The less dense hot air then rises up above the more dense cold air much like wood floats on water because wood is less dense than water. This floating effect in a less dense medium is called a buoyant force or a displacement force. Our primary goal is to find a way to utilize the excess heat trapped in the attic of homes. We will show the proof of theory using a model house, thermoelectric generators, and custom built heatsinks. The thermoelectric generators will be wired in parallel to use the temperature difference between inside the attic and outside of the house to create electricity. The electricity will be stored and used as an energy source to power utilities in the house. This project will benefit people that live in extremely frigid and humid areas where there is a great difference in temperature between the indoors and outdoors.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adroja, Mr Nikunj; B.Mehta, Prof Shruti; Shah, Mr Pratik (2015-03-01). &quot;Review of thermoelectricity to improve energy quality&quot;. 2 - Issue 3 (March-2015). JETIR.</td>
</tr>
</tbody>
</table>

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).
Linear polarizers have a simple use, to block some light but not all, but which photons should be blocked and which should pass? That question poses a serious problem in physics. If two polarizers are placed in series with an arc length of 90° there should be no light that passes, but if a third polarizer is placed between the two it will actually allow more light to pass even though more polarizers should mean a darker shade. This strange property of light is called Bell’s Inequality and it is a major foundation of what makes quantum physics so confusing. To quantify Bell’s Inequality we will create a system with three linear polarizers in series with a laser and a lux-meter used to measure the light intensity from the beam. The first polarizer will have a constant angle of polarization equal to 0°, the other two polarizers will be independent variables ranging from 0° to 90°. The light intensity measured on the lux-meter will be the dependent variable ranging from 0% to 100%. A solution to Bell’s Inequality will allow quantum computers, a cutting edge technology to vastly improve computational skills as well as lower costs. This will also cause a revolution within the quantum physics and science community.


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).
Battling the Heat Island Effect: Improving the Heat Mitigation Properties of Cool Materials Through the Modulation of Surface Geometry

James Li, Konrad Siebor

The objective of this project is to improve the heat mitigation properties of cool materials by modifying the surface geometry of the substrate onto which the material is applied. Cool materials exhibit impressive reflectivity in the visible and near-infrared spectrum combined with high emissivity in the infrared spectrum. These materials can thus lead to reduced electricity costs and the mitigation of the heat-island effect when applied to surfaces in urban environments. Different surface patterns have been shown to impact reflectivity and emissivity values for natural structures such as snow and soil patterns. Moreover, previous research has focused on changing the chemical composition of the cool materials itself in an attempt to improve its heat mitigation capabilities which oftentimes involves materials that are not scalable in a commercial setting. In this experiment, acrylic squares were laser-etched to obtain various pseudo-random surface patterns created by an algorithm onto which an acrylic elastomeric cool coating was applied. A heat lamp that mimicked the solar spectrum applied thermal energy to the system at different incidence angles to stimulate the circadian movement of the sun. The heat mitigation properties of the cool coating layer were quantified by measuring the change in temperature of a copper block placed underneath the cool coating layer through a temperature probe. Data collection is currently in progress, and statistical analysis has not yet been performed in order to determine any significant trends in the data.


# Engineering Mechanics (1300)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1301X12</td>
<td>Baron, William</td>
<td>Can Polycyclic Aromatic Hydrocarbons be Removed From Curing Smoke using a Filter?</td>
</tr>
<tr>
<td>1302X12</td>
<td>Chelluri, Sriya</td>
<td>The Effect of the Wing Design on the Speed of a Wind Turbine</td>
</tr>
<tr>
<td>1303X11</td>
<td>Di Girolamo, Jacob</td>
<td>The Designing and Prototyping of Pneumatic Tools That Are Capable of Being Produced Using Additive Manufacturing</td>
</tr>
<tr>
<td>1304X12</td>
<td>Jolly, Madison</td>
<td>Detecting Drowsiness at the Steering Wheel</td>
</tr>
<tr>
<td>1305T12</td>
<td>Carroll, Shane</td>
<td>Development of a control surface reliant GPS Guided Recovery System During Weather Balloon Descent to Facilitate Retrieval Efforts</td>
</tr>
<tr>
<td></td>
<td>Kanungo, Rishiraj</td>
<td></td>
</tr>
<tr>
<td>1306X12</td>
<td>Loeffler, John</td>
<td>Why Companies Should Buy Old Trucks</td>
</tr>
<tr>
<td>1307X12</td>
<td>McFadden, Rebecca</td>
<td>Altering Intersection Geometry to Improve Traffic Flow During Peak Hours</td>
</tr>
<tr>
<td>1308T11</td>
<td>Ho, Phu Nguyen, Tue</td>
<td>Utilizing Thermoelectricity to Create an Electric Generating Tire</td>
</tr>
<tr>
<td>1309X12</td>
<td>Nibbelink, Benjamin</td>
<td>A Study of a Canard-Wing Configuration with Various Canard-Winglet Characteristics</td>
</tr>
<tr>
<td>1310X10</td>
<td>Premkumar, Alfred</td>
<td>Programmable Maglev System</td>
</tr>
<tr>
<td>1311X12</td>
<td>Rentsch, Nicholas</td>
<td>Dimples on Fan Blades in a Turbine</td>
</tr>
<tr>
<td>1312X12</td>
<td>Rodriguez, Alexander</td>
<td>HMGH MKII</td>
</tr>
<tr>
<td>1313X12</td>
<td>Schloer, Gwyneth</td>
<td>Mathematically Accurate, Double-Axis Microgravity Simulator</td>
</tr>
<tr>
<td>1314X12</td>
<td>Tsuyuki, Emiko</td>
<td>Determining the Efficacy of the Use of Commercial Off-The-Shelf Parts Exposed to Extreme Space Conditions During Cubesat Engineering</td>
</tr>
<tr>
<td>1315X12</td>
<td>Warner, Collin</td>
<td>The Effect of Helmet Chin Strap Orientation on Ability to Reduce Concussions</td>
</tr>
<tr>
<td>1316X12</td>
<td>Williams, Caitlin</td>
<td>A More Efficient Method to Sanitize Hands in Hospitals</td>
</tr>
</tbody>
</table>

Category Student Count: 18
Can Polycyclic Aromatic Hydrocarbons be Removed From Curing Smoke using a Filter?

William Baron

Smoking foods are an ancient and current practice of curing and preserving foods. Used to preserve animal flesh and to flavor other foods, the practice is seen in several diets and casual snacks. Smoking comes with increased cancer risk, similarly in tobacco smoking, burnt particles called Polycyclic Aromatic Hydrocarbons occur when organic matter is combusted. PAHs are carried by the smoke onto the morsels and are, as a result, consumed. PAHs are a group of molecules that are carcinogenic to the human body. Ingestion from breathing or from consumption can cause cancer to occur. PAHs and multiple cancers have been linked together.

PAHs can be removed from the air with the use of a filter or filtration system. Combination of a filter and a smoker could solve this problem and remove most PAHs from the smoke, leading to heavily decreased cancer risk. Filters will be prototyped and finalized to test the effectiveness of removing the PAH particles.

A filter will be prototyped and constructed and inserted into the smoker for testing. The smoker is then let to run for the normal length of time that it takes to ‘hot smoke’ meat of certain weight. The filters will then be examined for effectiveness as well as having a PAH indicator strip inserted inside of the smoker. Data will be recorded from the effectiveness of the filters and the quality of the smoke.


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 Wing Design on the Speed of a Wind Turbine
Sriya Chelluri

The engineering goal of this experiment was to refine the wing design of wind turbines to optimize speed. Each of these designs mimics a gliding animal (independent variable): specifically, Mycteria americana (Wood Stork), Lasius niger (Garden Ant), Glaucomys sabrinus (Northern Flying Squirrel), Parexocoetus brachypterus (Flying Fish), and the control (wind turbine). As a result, the dependent variable, the speed (in rpm), was affected. Two aerodynamic forces will impact the systems: air reaction force and rotational force. At the fan’s highest speed, the mean for the stork, ant, constant, squirrel, and flying fish are listed (in rpm) respectively: 62.2, 38.2, 37.6, 39, 73.4. At the fan’s medium speed, the means are listed (in rpm) respectively: 47.6, 31, 17.4, 38.8, 61.2. At the fan’s lowest speed, the means are listed (in rpm) respectively: 39.6, 9.8, 3, 26.6, 50.2. The hypothesis was supported: both the stork and fish wing speeds (in rpm) remained constant as the speed of the wind decreased. They performed very consistently and with a high rpm. An Anova test showed that the p value was less than 0.0001. By understanding which particular designs perform well, it will allow for each geographical area to specifically design turbines that will benefit them the most. This study can be furthered by implementing a mechanical assembly to mimic the motion of the animals to research the effect of translational force on wind speed. With this, the experiment will account for all three aerodynamic forces: translational force, air reaction force, and rotational force.


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 Designing and Prototyping of Pneumatic Tools That Are Capable of Being Produced Using Additive Manufacturing

Jacob Di Girolamo

The purpose of the engineering project is to determine the feasibility of using additive manufacturing to produce pneumatic tools. 3D printing is becoming an increasingly popular method of manufacture but there are a lack of pneumatic tools being produced using printing. The tool being designed and prototyped is a multipurpose pneumatic motor that is being tested to meet standards of usability for different tools. The motor is a Tesla turbine with fourteen discs that exhaust the air through slots in the shafts towards the rear of the tool. The tool is composed of eight unique components and a total of twenty-one components, excluding all pneumatic fittings. Of the components, eighteen of them are 3D printed, one is a machined steel shaft, and two are ball bearings. The tool is a size that can be held and easily be adapted to look and feel similar to commercially available pneumatic drills or grinders. The tool is being tested on a basis of rotor speed measured in rpm, the number of components that cannot be 3D printed, how long the turbine can run without wear, safety, and its practical usability as specific tools. Preliminary testing shows the prototype turbine is capable of reaching 2400 rpm at 40 psi and will likely be capable of drilling, sanding, and grinding. It is expected that the final iteration of the tool will be effective at drilling, sanding, and grinding and will be comparable to a multi-purpose commercially available tool that is intended for similar tasks.


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).
Detecting Drowsiness at the Steering Wheel

Madison Jolly

Driving while drowsy is a leading cause of car accidents. Similar to driving while under the influence, driving drowsy slows reaction time. While the effects of driving intoxicated are generally known, the detrimental effects of driving while drowsy are typically less emphasized in society. It is also more difficult for a driver to know when he or she is too fatigued to drive. Creating a device that notifies a driver when he or she may be too sleep deprived to drive could potentially lessen the rate of car accidents related to fatigued driving.

For this device force sensors were used to measure the hand grip of the driver. The force sensors were connected to a breadboard circuit which sounds an alarm if the force sensors have pressure applied to them. Challenges have been identified and changes are being made to the working model.

This device would be able to be put in cars and allow for a way drivers can track if they may be too tired to drive. Future research will possibly create a device that would take into account more factors of being drowsy such as heart rate and eye movement. This would allow for a device that can assess if someone is falling asleep at the wheel more accurately.


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).
Development of a control surface reliant GPS Guided Recovery System During Weather Balloon Descent to Facilitate Retrieval Efforts
Shane Carroll, Rishiraj Kanungo

Weather has been a constant problem for developing countries concerning disasters and predictability in its patterns. Atmospheric balloons, which can drift kilometers away from the launch point, are often lost during recovery and can be a hazard to the environment. With this in mind, this experiment is set out to facilitate the process of weather balloon recovery in order to improve the affordability of weather data collection. The proposed solution was to design a more efficient and reliable weather balloon which would use spatial awareness technology and GPS directed control surfaces to guide the capsule to a set recovery point during the descent phase. To achieve this result, an Arduino Uno along with multiple extensions such as the Adafruit Ultimate GPS Breakout and MPU-9050 will be used for real time collection temperature, GPS coordinates, orientation, and altitude data. With these two components, it would be possible to monitor the weather balloon’s path of travel alongside the data collection which could result in the increased accuracy of predictions. Data collection is currently ongoing and the experiment will be considered a success if the average distance between the launch and recovery points is decreased when the recovery system is enabled. Future research could explore the possibility of prolonged weather balloon flight and active data transmission through the use of onboard equipment.


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).
Why Companies Should Buy Old Trucks

John Loeffler

The project was done to see what much of a difference Diesel Exhaust Fluid systems made on the performance of new trucks vs. older trucks without the Diesel Exhaust systems. Trying to limit emissions on diesel powered trucks has been done since 2004 which was when the Environmental Protection Agency mandated that all diesel-powered truck come stock with an Exhaust Gas Recycling system, followed in 2007 with the mandate of a Diesel Particulate Filter and in 2011 with the mandate of Diesel Exhaust Fluid systems. To test the performance of the two trucks they were driven over a course of fifty miles five times while hauling 1000lbs and another five times without hauling anything. The the trucks should have the same fuel economy however, over the course of testing, it was found that the 2002 model year got almost three miles a gallon better than the 2015 model year hauling and almost four miles a gallon better without hauling. However, the diesel exhaust systems did do their job in that the 2015 model year did produce fewer high range engine revolution CO2 emissions but the added weight of the systems did reduce the fuel economy by 22% not hauling and 23% hauling. Aside from holding a better fuel economy in both hauling and non-hauling the 2002 model year costs less to maintain in the long run as parts are cheaper making them optimal for a new company.


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).
Altering Intersection Geometry to Improve Traffic Flow During Peak Hours
Rebecca McFadden

As suburban areas become more populated, the improvement of traffic flow becomes more critical to the efficiency and welfare of the community. Many times, however, small-town intersections are ignored by traffic engineers due to the low volume, and therefore small amount of delay, that these intersections experience. Yet in the case of the intersection of Main Street and Maple Avenue, we see a small-town intersection experiencing more traffic than it is designed to handle due to the influx of traffic from multiple schools. The goal of this experiment is to collect data on the volume of traffic during the peak hours and use a computer simulation to analyze whether or not a roundabout or a different signal timing pattern would handle the high volumes more efficiently. Roundabouts have been examined in previous studies, and have been found to have less vehicle delay and congestion than signalized intersections. Volumes and signal timing were collected for each input direction for five weekdays and will be run through the simulation software VISSIM, which allows users to input hourly flow volumes, intersection geometry, flow ratios, signal timing, and vehicle types to model the intersection in its current state. These inputs can then be modified to improve the simulation output and overall efficiency. As soon as the data is fully collected and compiled, the simulation can be run for both the original and altered signal geometry and timing to determine if re-designing the intersection would improve the flow rate through the intersection.


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).
Utilizing Thermoelectricity to Create an Electric Generating Tire
Phu Ho, Tue Nguyen

The project conducted was to test the ability of creating a tire that yields the properties of a thermo-electric generator using the Spin-Seebeck effect. The project is to see how different models, the independent variable, can produce a higher voltage, the dependent variable, compared to an original Thermo-Electric Tire, which served as the control. To investigate the voltage output of each design, a working-station was created to replicate the heat created between the tire and asphalt. Theories plus math equations were to support this procedure. The results show potential for the future usage of thermoelectric generators in the field of vehicles. The Spin-Seebeck effect, when applied, can produce a higher voltage output while maintaining structural flexibility. By combining hypothesized analysis and further experiments, it is found that creating the TET would not be able to withstand a weight of a car and will need to be support with interior structural designs. It has been concluded that the tire is capable of producing a voltage using heat-flux and the hypothesis is supported, which was the effect of different models on the voltage output of the tire. Due to lack of time and resources, a prototype was not created. For further research, how much pressure can the tire withstand.


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 of a Canard-Wing Configuration with Various Canard-Winglet Characteristics
Benjamin Nibbelink

Canard-wing configurations can provide important benefits to plane performance that conventional tail-plane configurations cannot. Studies have shown that in a close-coupled canard-wing configuration, vortices created in the wake of the canard can contribute to increased wing performance. Wingtip vortices are vortices that arise from a pressure differential between the bottom and top of a wing, causing higher pressure fluid below the wing to swirl around the tip of the wing to reduce the pressure differential. Winglets are devices positioned on the end of a wing that have shown to affect the position and strength of wingtip vortices. This study focuses on a system involving a canard-wing configuration with a winglet on the canard, with the expectation that the winglet will affect the canard-wing fluid interaction. Wing performance and canard-wing interactions will be analyzed with respect to variations in winglet characteristics and canard positioning. Data collection 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).
Programmable Maglev System
Alfred Premkumar

Modern maglev transportation systems in use in Asia show extreme potential through energy conservation, but nearly all of these systems appear to be fully linear. The purpose of this project is to create an array of electromagnets that can be controlled by a computer through software, altering each electromagnet’s voltage inputs to create varying, joined electromagnetic repulsion fields for non-linear transportation. By doing this, a repulsion terrain would be created, allowing a same polar object to move around on the system’s vicinity. Multiple electromagnetic repulsion fields would overlap with another and contribute to pressuring a multitude of forces on the object. These forces can range from creating different placements for different objects or having multiple nodes of the system create something akin to a Halbach array in order to propel different objects for any purpose. The system is currently being programmed as a simulation in Java through the Eclipse IDE using a user interface, accepting inputs regarding variables such as voltage for every node to display outputs in force for every node and the system as a whole, showing its impact on a same-charged object. This is an ongoing project, with a fully physical version of the project being planned for next year. This simulation is a test for building said project. The impact of this is that it creates a non-linear transportation system that can be manipulated for almost any purpose, especially for cargo transportation.


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 research project was to determine whether a turbine could produce more suction if vortex generators were implemented into the turbine blades. Based on preliminary research, vortex generators should allow more air to pass through the turbine blade, thus inducing a greater vacuum force. Increasing the suction in turbines is necessary to improve the performance and efficiency of modern gas-turbine engines, often found in commercial aircraft. Furthermore, high performance cars rely on small turbines called turbochargers. Turbochargers maximize the air in combustion chambers.

The experiment was conducted with a 3d printed, single scroll, turbocharger that was mounted to a base. An electric motor was mounted to the same base, and its shaft was connected directly to the turbine blade. Data was collected with an airspeed sensor, which was housed in front of the intake port. The turbine blade with vortex generators has yet to be tested. Once testing is completed, both sets of data can be analysed. If the results show a marginal improvement in performance, the application of this research can be monumental for turbine technology.


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 - 2018**

<table>
<thead>
<tr>
<th>HMGH MKII</th>
<th>Alexander Rodriguez</th>
</tr>
</thead>
<tbody>
<tr>
<td>The HMGH MKII (Hand-held Motorized Grappling Hook) is a continuation project of last years HMGH. The engineering goal of the MKII is to improve upon the HMGH and further develop a more refined prototype. In addition to improvements on the HMGH the MKII includes an ancillary device. This device facilitates the transportation of items and or supplies as well as provides a base for modular upgrades. The device is titled LC (Line Crawler) as it traverses along the MKII’s Kevlar line. To meet the engineering goal there are three requirements; the MKII needs to lift 180 pounds, launch a projectile and line 50 feet, and be at least 35% lighter than the HMGH.</td>
<td></td>
</tr>
</tbody>
</table>


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).
Mathematically Accurate, Double-Axis Microgravity Simulator
Gwyneth Schloer

Recently, the desire to travel out into space other planets and beyond has become both more popular as well as more feasible. In order to travel further into space, scientists must be able to account for every scenario that could possibly occur in a microgravity environment. However, resupply missions to the International Space Station (ISS) are quite costly especially with the limited amount of money and resources. Therefore, the simulation of microgravity in ground laboratories is becoming increasingly essential due to the high cost of space missions to the ISS and the strong desire to explore space.

This experiment is intended to create a new type of effective double-axis microgravity simulator. Microgravity has been simulated through free fall, magnetic forces, and lastly through rotating axes. Previously made double-axis microgravity simulators used two motors to spin both axes. However, this new simulator design uses only one motor with a 90 degree converter to spin both axes, increasing efficiency while effectively simulating microgravity. The goal is to simulate microgravity, not zero gravity, because even on the ISS there is still microgravity (or else the ISS would be floating through space right now). The method for simulation is to average out the gravity vectors to get a gravity vector close to 0. Using this new and accurate microgravity machine design, scientists will be able to test the effect of microgravity on various organisms. This can greatly reduce the costs needed to perform tests in microgravity conditions.


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 Efficacy of the Use of Commercial Off-The-Shelf Parts Exposed to Extreme Space Conditions During Cubesat Engineering

Emiko Tsuyuki

In order to add to the body of knowledge regarding weather, communications, and mapping, Cubesats are a class of nanosatellites which possess standard sizes and forms. The standard Cubesat size uses a "one unit" or "1U" measuring 10 x 10 x 10 centimeters; however, this design can also be extended to larger sizes. In this research, an iPhone 5c and a Samsung Galaxy Note 3 were tested with solar power banks to determine whether it was possible to replicate Cubesat components using off-the-shelf parts. Their reactions in extreme situations and environments similar to those in space were tested. Parts were tested in conditions -14 degrees Celsius to 45 degrees Celsius, increasing by three degrees each testing run during seven hour-long cycles. They still functioned after. Phones were also placed in a thermal vacuum chamber overnight; the iPhone experienced small damage but recovered and worked normally after a few days. The Samsung functioned normally. Finally, phones were subjected to vibration in both the x and y direction, starting at level twelve and decreasing by three until reaching zero. They experienced three cycles each. In each situation, the phones maintained integrity. It was determined that the possibility of producing a working Cubesat with commercial off-the-shelf parts is strong; the parts most likely have the ability to survive harsh conditions encountered by their placement in space and subsequent stays in the solar system. This technology presents a new platform for investigations and advanced research, all in a more compact and more cost-friendly manner.


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 Helmet Chin Strap Orientation on Ability to Reduce Concussions
Collin Warner

The purpose of the research was to see if compromising the integrity of the chinstrap reduced helmet efficiency. Helmets protect a player by increasing the time an impact force is applied reducing the impulse experienced. The chinstraps role is to keep the head in contact with the protective padding and to keep the helmet from falling off but not all players properly fit their straps before use. For testing six groups were used: no helmet, properly fitted, loose fitted, no chin-strap, and properly fitted and loose fitted with one side unstrapped. The helmets were dropped 6 ft with an accelerometer and ballistics head inside. The p-value was 0.000552 so the null hypothesis was rejected. The groups from least to greatest protection: no helmet with 67.53 g’s, no-chinstrap with 38.79 g’s, loose and properly fitted chinstrap with one side unstrapped at 14.28 and 11.73 g’s respectively and properly fitted chinstrap with 54.43 g’s. The properly fitted helmet performed better than the control and was also the only group to keep the head inside the helmet after impact. All compromised chinstraps, therefore, experienced lower acceleration values because the force was experienced over a longer time. The data supports the claim that a weakened chinstrap is not as effective at protecting a player. This risk is amplified if in a knockdown blow the helmet comes off because an impact with the ground would produce acceleration values like that of the control. The loosely fitted helmet was an outlier and therefore not included.


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 More Efficient Method to Sanitize Hands in Hospitals

Caitlin Williams

Proper hand hygiene is vital to good health in hospitals, and the general public community. However, many people do not wash their hands for the proper amount of time to remove all the pathogens, or they skip the step completely due to the drying effects repetitive hand washings can have. Similarly, alcohol based hand sanitizers are used to kill bacteria, however many nurses and doctors forget this step while leaving a patient’s room. In order to be successful, a solution must have similar results to washing hands, while being able to complete the task in less time.

A design for a hand hygiene station has been created using a simple acrylic exterior. In order to initiate the program, a motion sensor recognizes the hand has entered the device. Once the loop begins, antiseptic is sprayed, a UV light is turned on, and the motion sensor begins to look for hands again. A Raspberry Pi is used to control this loop, and a counter may be added to run tests on the probability of a user stopping and taking the time to use the device. The time to run the loop, remove hands, and re initiate the loop for a second run for the other side of the hand is about 10 seconds, 5 seconds faster than the average time spent washing hands. This number may seem small, but it will quickly add to minutes and even hours saved over 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).
### Environmental Engineering (1400)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1401T11</td>
<td>Bhangui, Isha Sosale, Medhini</td>
<td>Layer-by-layer Self-Assembly to Make Electrospun Chitosan Hydrophobic for Microbead Removal</td>
</tr>
<tr>
<td>1402X12</td>
<td>Challis, Harry</td>
<td>Determining the Effectiveness of United States Army Corps of Engineers Levee Construction in Hurricane Prone Areas</td>
</tr>
<tr>
<td>1403X12</td>
<td>Ezera, Nneka</td>
<td>The Creation of Sorbents from Natural Waste Material to Aid in the Remediation of Chemical Spills</td>
</tr>
<tr>
<td>1404X12</td>
<td>Ho, Jovia</td>
<td>The Effect of Temperature on the Volume of Grease-Degradation Fulfilled by the Bacteria Serratia marcescens and Bacillus cereus in a Recycling Plant Simulation</td>
</tr>
<tr>
<td>1405T10</td>
<td>Joshi, Vrushit Maloney, Grace</td>
<td>Grow Greenly</td>
</tr>
<tr>
<td>1406T12</td>
<td>Kaloji, Anuraag Pongsugree, Aaron</td>
<td>The Effect of Microbial Cellulose on the Development of Non-plant Based Paper</td>
</tr>
<tr>
<td>1407T12</td>
<td>Choudhari, Rishabh Lutterodt, Andrew</td>
<td>Converting Desert Sand to Arable Soil</td>
</tr>
<tr>
<td>1408T12</td>
<td>Karam, Gabrielle Popal, Marwa</td>
<td>The Effect of Iron (III) Nitrate on the Efficiency of the Hydroponic Phytoremediation of Eruca satvia</td>
</tr>
<tr>
<td>1409X11</td>
<td>Rao, Rohit</td>
<td>Using a Drone to Find Plastic Bottles in Waterways</td>
</tr>
<tr>
<td>1410X12</td>
<td>Wotorson, Faith</td>
<td>Testing the Quality of a Homemade Water Filter and Water Distiller</td>
</tr>
</tbody>
</table>

Category Student Count: 15
Layer-by-layer Self-Assembly to Make Electrospun Chitosan Hydrophobic for Microbead Removal

Isha Bhangui, Medhini Sosale

Microbeads are small, hydrophobic plastic particles found in cosmetic products that currently pose a severe environmental threat. According to Talvitie et al. (2017), current technologies that exist to deter microbead pollution are too expensive for wide-scale application. Therefore, cheap and environmentally-conscious alternatives for microbead removal are being investigated. One such alternative is chitosan, a hydrophilic biopolymer containing hydroxyl and amine functional groups (Philippova & Korchagina, 2012). These groups can be chemically modified via layer-by-layer self-assembly, in which chitosan amine groups interact with calcium lignosulfonate solution to increase polymer hydrophobicity and microbead removal capacity (Luo et al., 2012). Therefore, the purpose of this investigation is to synthesize hydrophobic electrospun chitosan-based composites to remove microbeads from water. In this process, chitosan meshes will be electrospun and then characterized via SEM, flow rate, and tensile strength tests to determine their practicality in water filtration. Successful modification of chitosan hydrophobicity will be quantified through a water-contact angle test. Microbead removal will be tested by incubating meshes in a microbead/water mixture and investigating how this changes their mass. Preliminary trials suggest that a 3 percent w/v solution of low molecular weight chitosan in 90 percent acetic acid yields a solution of ideal viscosity for electrospinning. Overall, this research would contribute to the synthesis of an inexpensive, biodegradable mesh with the potential to filter harmful microbead pollutants from 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).
Determining the Effectiveness of United States Army Corps of Engineers Levee Construction in Hurricane Prone Areas

Harry Challis

The United States has employed the Army Corps of Engineers in building and repairing levees affected by hurricanes and in-land flooding. This engineering takes place to make locations where people live safer and to protect natural habitats. The purpose of this research was to determine whether levees the United States Army Corps of Engineers constructed were effective in reducing and preventing hurricane driven in-land flooding when compared to storm surges that occurred prior to levee placement.

Maps created via ArcGIS were analyzed to determine this effectiveness by tracking historical hurricane paths, storm surges and levee placement. These maps indicated engineering and addition of levees, while they did lessen damage in certain locations, did not protect entire areas. This is true in New Orleans which suffered damage from category 5 Hurricane Katrina, experiencing eight feet of flooding in Mid-City. After Katrina, with the addition of more levees, New Orleans experienced greater protection during Hurricane Isaac. To increase protection, placement of additional levees in areas west of Lake Pontchartrain is recommended. Since hurricanes travel inland, it is better to construct levees towards the western side of Lake Pontchartrain instead of the southern to reduce the distance flooding moves in-land. Additional analysis would entail determining whether rerouting of streams and rivers by the United States Army Corps of Engineers affects the degree of storm surge damage. As temperatures change and strength of hurricanes increase, determining optimal location for levee construction and the insistence of the importance of funding for such projects is 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 Creation of Sorbents from Natural Waste Material to Aid in the Remediation of Chemical Spills
Nneka Ezera

Soil and water pollution have become ever increasing environmental issues that are the subject of various types of regulation. Currently, many materials employed to clean up spills have detrimental effects on the environment such as the chemical 2-butoxyethanol. It was the intent of this research to determine whether natural waste substances could be used to bioremediate spills.

Dried peels of oranges, avocado, and pomegranate were pulverized into powder form and applied to water spills to determine the capacity for absorption. Powder was applied to spills and the ratio of material to water absorbed was noted after a time period of five minutes. In order to determine the amount of powder used, excess water was drained and the masses were obtained before and after the water was drained. Pomegranate powder yielded the lowest level of absorbency while the pomegranate displayed an absorbency level slightly below that of the avocado. Orange peel powder provided the greatest absorbency with 0.21 grams per milliliter being absorbed.

Further research would entail testing the absorbency ratios of these natural materials on the remediation of chemicals other than water. This could provide additional data as to the types of chemicals that could be safely remediated from the environment with natural materials and would prevent these chemicals from entering the ecosystem. This could lead to an eco-friendly approach to using sorbents in absorbing chemicals.


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 Volume of Grease-Degradation Fulfilled by the Bacteria Serratia marcescens and Bacillus cereus in a Recycling Plant Simulation

Jovia Ho

Over five billion pizzas are sold worldwide every year. Each pizza arrives to a home in a box made of corrugated cardboard drenched in grease oil. This results in boxes incapable of being recycled in community recycling plants. With population increase and quantity of pizza purchased yearly, landfills will be contaminated with these fatty acids, harming soil chemistry and leaching dangerous oils into nearby water sources. The goal of this experiment was to see if bacteria have the potential to biodegrade saturated fats in hopes of removing these fatty acids from pizza boxes, making recycling possible. The bacteria, *Serratia marcescens* and *Bacillus cereus*, known for biodegrading automobile oils, was used in this research. For the purpose of this experiment, palm oil was substituted for the saturated fats commonly found in pizza boxes. The two bacteria were cultured separately in liquid nutrient broth, then inserted into test tubes containing five milliliters of water and three milliliters of oil. To further the recycling plant simulation, the bacteria were tested in a water bath at different temperatures. The change of volume, measured before entering and after 48 hours in the water bath, determined the efficiency of the bacteria. More research needs to be conducted in order to support the hypothesis that the two bacteria are capable of biodegrading saturated fats.


**LCPS RSEF OFFICIAL ABSTRACT - 2018**

Grow Greenly  
Vrushti Joshi, Grace Maloney

The primary purpose of this experiment is to engineer a plant pot made entirely from organic materials. The hypothesis states that if a biodegradable plant pot is made out of all organic materials, it will enhance a plant’s growth and development. This is based on the fact that all of the ingredients being used are not harmful to the environment, yet beneficial to the plant. The plant pots are then tested for the purpose of gathering data regarding the improvement of plant growth in the biodegradable plant pot versus a plastic plant pot. To test the plant pots, twenty were tested in the lab while an additional twenty were sent to the South Riding and Leesburg Gardening Clubs. Plant growth was measured and recorded once each week. We also had a control which was a plant planted without the biodegradable pot. Using the data, the ratios were modified accordingly to ultimately create the most beneficial plant pot. To create the ratios, various ratios of compost and waste pellets from a local water facility with cornstarch and water as binding materials were used. To combine these ingredients, a blender, aluminum tin, and an oven created the hardened pot structure. Results are still pending to determine the effectiveness of these organic 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 Microbial Cellulose on the Development of Non-plant Based Paper
Anuraag Kaloji, Aaron Pongsugree

The purpose of this project is to test an alternative to traditional paper making that uses plant, cotton, and wood fiber cellulose. Cellulose, used for paper making as of now, is the major constituent of cotton (over 94%) and wood (over 50%). Our alternative is using cellulose made from Gluconacetobacter xylinus a bacteria culture instead of the cellulose that comes from wood, plants, and cotton. This would be beneficial to the world because, if used on a large scale, using bacterial cellulose to produce paper would reduce the amount of need for wood which would lead to the cut back of annual deforestation. Although we use cotton and paper in our experiments, we used a very small amount (about 3% to 40% of total mixture). Micro-bacterial cellulose, also known as microbial cellulose, is an unbranched bio-polymer linked glucopyranose residue. The cellulose is produced naturally by bacterial gel sheets. Chains of BC aggregate to form sub fibrils which are crystallized into microfibers (Kudlicka, 1989) and then into ribbons (Jonas and Farah, 1998). It grows into its biofilm form naturally over a time window of one to two weeks. For our paper making procedure, we use materials such as Gluconacetobacter xylinus, bleach, glue, starch, cotton fibers, and small amounts of paper throughout trials. Our procedure includes using a blender to make a mixture for a paper mold to shape and replicate the structure of traditional paper. We remove water from the mixture with a sponge and dry out the molded mixture overnight. Trials have produced paper of various strengths and brittleness.


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).
Converting Desert Sand to Arable Soil
Rishabh Choudhari, Andrew Lutterodt

The issue of diminishing of land for farming is an issue that impacts every human alive. By using mycelium to convert sand to a viable platform to grow crops in, vast deserts can possibly be converted into copious amounts of farmland. The steps taken to achieve this goal involved mixing different ratios of mushroom substrate with sand, adding moisture, and observing the growth of mycelium with the overarching goal being to kill the mycelium and test the ability to grow crops. Mycelium is a threadlike structure that roots from fungus. One species of fungus that was utilized in the research and experimentation is Pleurotus Ostreatus, the Oyster Mushroom, because of its rapid rate of growth, and it is already produced in large quantities for consumption. Mycelium helps forests, gardens and other ecosystems thrive. Therefore, it is an ideal candidate in helping convert a desert into arable land and it is a step in the right direction of ending food shortages around the world. Two ratios of sand to mushroom substrate were tested, 50% sand to 50% mushroom substrate by volume, and 65% sand to 35% substrate by volume, and triplicates were made for each. The aim of this portion of the experiment was to determine which mixture of sand to substrate was optimal for the growth and success of mycelium. Following these tests, adequate ways to kill the mycelium were sought in order to ensure the future growth of a planted crop without the hindrance of the mycelium.


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 Iron (III) Nitrate on the Efficiency of the Hydroponic Phytoremediation of Eruca satvia

Gabrielle Karam, Marwa Popal

While iron is necessary for healthy plant growth, an excessive amount causes damage to plants. Iron ore mines and iron pipes expose plants to damaging amounts of iron which extend to the groundwater, harming countless organisms. Phytoremediation, the ability for certain species of plants to absorb heavy metals, was applied towards an experimental design to protect the environment against harmful amounts of iron. Eruca satvia, a plant that conducts phytoremediation, was grown hydroponically and distributed among three different concentrations of iron (III) nitrate over five days. The extent to which the Eruca satvia absorbed the iron reflected its efficiency in the ability to absorb abnormal concentrations of iron from water.

Using a spectrophotometer, the iron concentrations of the water were measured and found have no significant difference (P>0.05) when compared with controls. Regarding the biomass of the plants, an ANOVA test showed that the data was insignificant with a P-value of 0.07. However, the biomass was highest in the Eruca satvia plants treated with 500 parts per million (ppm) when compared with the control group and 100 ppm plants of iron (III) nitrate.

Sources of error included the lack of circulation in the hydroponic systems. Results were supported by data from spectrophotometry and biomass. Future research will allow knowledge of plants and their abilities in phytoremediation of toxins and heavy metals to be implemented towards the creation of bioremediation gardens.


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 a Drone to Find Plastic Bottles in Waterways**

Rohit Rao

Plastic bottles are a cause of the death of fish and blocks water flow by creating little dams where these bottles are gathered. Chlorinated bottles release harmful chemicals into the water and soil. The chemicals that are falling into water are hurting fish and others. Bottles made of synthetic plastic are not all biodegradable.

Ten empty plastic water bottles were scattered randomly over a field in a 6 foot square area. A drone was used to take images of the area and the images were downloaded to a computer. A program was written to identify pixel by pixel the individual plastic bottles from the background by color. Initial results show that the program successfully recognized 9 out of the 10 bottles. This was repeated four times, each time hiding a more and more of each bottle in order to test the limits of the program.

Full bottles recorded was easily identified compared to the bottles that were only one fourth visible which were difficult for the program to depict. Results for all the types of bottles are pending.

This could later been used to have a drone take multiple images of a waterway and use the pictures to detect areas with a high density of trash for remediation.


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 the Quality of a Homemade Water Filter and Water Distiller

Faith Wotorson

Water has a direct correlation to quality of life in a certain region; the cleaner the water is and the more water there is to drink, the better life seems to be. This experiment is being conducted in order to test the efficiency of a homemade filter and distiller to see how clean the water comes out. This experiment will aid in the creation of a more fool-proof water quality system that water-scarce places can use. The experiment requires you to build a filter and distiller out of water bottles, sand, rocks, and cotton. It uses a generic water quality test to find levels of lead, iron, any sulfates, and bacteria inside of the filtered and distilled water. The conduction of the experiment is as follows: put the dirty water through the filter, after that, put the filtered water into a can or cup and place into distiller, pour the condensed water into microtubes, place microtubes into centrifuge, spin in centrifuge, then test the water. My independent variable would be the amount of water being put into the filter. My dependent variable is would be the levels of iron, lead, and bacteria found in the water. All the data would be compared to the control group, which is un-filtered, and non distilled water.

The filter being used throughout the experiment is composed of materials that cannot be cleaned throughout the experiment. Theoretically, the first three trials will most likely produce the cleanest water. After that, the filter will begin to get dirty and bacteria will remain inside it because there is no way to wash it, and the water will begin to come out dirtier. The hypothesis that underlined the experiment was: if one was to build a homemade water filter and distiller, then it will produce clean water. It’s a straightforward hypothesis, however the data does not support it. The filter started to produce clean water but as it was used more often, the levels of bacteria and elements inside it increased. The independent variable really had no effect on the dependent variable, but, there was a substantial amount of error. The fact that the filter was made of materials that would not be able to be cleaned throughout the experiment leads to a buildup of bacteria. Which skewers the data completely.


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, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1501X12</td>
<td>Arana, Chloe</td>
<td>Engineering Silicone Polymers with an Olive Oil Solvent to Enhance Tensile Strength</td>
</tr>
<tr>
<td>1502X12</td>
<td>Azem, Noor</td>
<td>Creation of Self-Healing Concrete via Bacillus sphaericus formation of Limestone</td>
</tr>
<tr>
<td>1503X12</td>
<td>Christoph, Erin</td>
<td>Effect of Carbon Sources on the Production of Microbial Cellulose</td>
</tr>
<tr>
<td>1504T12</td>
<td>Dodge, Riley</td>
<td>The Effect of Types of Maglev Track on the Speed of the Train Car</td>
</tr>
<tr>
<td></td>
<td>Sosa, Steven</td>
<td></td>
</tr>
<tr>
<td>1505T12</td>
<td>Liles, Simon</td>
<td>The Effect of Various Carbon Based Covering Material for Super Capacitors on Total Energy Storage and Energy Density</td>
</tr>
<tr>
<td></td>
<td>Liles, Stuart</td>
<td></td>
</tr>
<tr>
<td>1506T12</td>
<td>Maloney, Sydney</td>
<td>Developing a Water Filter Using Electrospun β-lactoglobulin Amyloid Fibrils</td>
</tr>
<tr>
<td></td>
<td>Shangraw, Joseph</td>
<td></td>
</tr>
<tr>
<td>1507X12</td>
<td>Siddiqui, Abeer</td>
<td>The Effect of Natural Aggregates on the Compressive Strength of Concrete</td>
</tr>
<tr>
<td>1508X12</td>
<td>Urbano, Steffanie</td>
<td>Comparative Analysis of Adhesives</td>
</tr>
<tr>
<td>1509X11</td>
<td>Valluri, Maanasa</td>
<td>Second Skin Biodegradable Gel</td>
</tr>
<tr>
<td>1510T11</td>
<td>Armstrong, Allison</td>
<td>The Effect of Different Powders on Durability of Plastic Spoon Substitute</td>
</tr>
<tr>
<td></td>
<td>Wu, Megan</td>
<td></td>
</tr>
<tr>
<td>1511X12</td>
<td>Yannam, Megha</td>
<td>A Comparison of the Environmental and Antibacterial Effects of Biogenically and Chemically Produced Silver Nanoparticles using Danio rerio and Escherichia coli</td>
</tr>
</tbody>
</table>

Category Student Count: 15
Engineering Silicone Polymers with an Olive Oil Solvent to Enhance Tensile Strength
Chloe Arana

Polymers are created for many different uses in the engineering world. Polymer engineering is an important field, as many household devices rely on the development of more efficient polymers. Sealants for windows and kitchen appliances need constant improvement due to the nature of intense wear over time. As is typical with many polymers, the strength to weight ratio is important in development and engineering in order to provide the greatest structural integrity.

This research was conducted to enhance the weight-bearing properties of silicone sealant and develop a stronger polymer without the use of harmful chemicals. Olive oil was used based on its ability to strengthen polymers such as ultra-high molecular weight polyethylene. The experimental polymer consisted of 30 milliliters silicone and three milliliters of olive oil, while the control polymer consisted of 30 milliliters. Both were molded, cured, and tested to determine the degree of weight they could withstand.

Polymer molds were subjected to increasing weight and the weight at which they lost integrity was noted. Statistical analysis determined that the null hypothesis, that there is no difference in tensile strength and material behavior in silicone polymer with the addition of olive oil, was accepted. While tensile strength was not significantly different between the test groups, those polymer molds created with added olive oil were more flexible. Additional research would entail making symmetrical pieces of polymer and adding different types of vegetable oil. Continued research would be valuable because improved sealants could save consumers money and time in the future.


Reusch, W. Lipids. 2017. Available online at: https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/lipids.htm


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 - 2018**

**Creation of Self-Healing Concrete via Bacillus sphaericus formation of Limestone**  
Noor Azem

Scientists have discovered bacteria species which survive in the harsh environment of concrete. If provided proper nutrients, they produce limestone, filling micro-fissures before substantial cracks and structural deficiencies result. *Bacillus pseudofirmus* or *Sporosarcina pasteurii* in clay pellets with calcium lactate have been used to heal cracked concrete quickly.

This research’s purpose was to determine whether a method existed to heal concrete fissures other than encapsulating bacteria and food and mixing capsules in the concrete as it is poured. Liquid cultures of *Bacillus sphaericus* mixed with calcium lactate were poured into concrete cracks and observed over three weeks to determine healing. Grass was grown in a group of cracked slabs to determine whether their growth with the bacteria and calcium lactate would occur faster than the repair, resulting in the reformation and growth of cracks.

Due to minimal healing visible, acetic acid was added to the crack to determine the presence of limestone. Limestone had formed though not as quickly as was observed in research conducted by other scientists. Hence, natural concrete healing occurs via this method. Interestingly, it was observed that plants grown within cracks containing bacteria grew faster than plants in cracked slabs with no bacteria and faster than the formation of limestone, most likely due to nitrogen fixation by the bacteria.

Additional research time may exhibit the complete healing of concrete cracks and that plant growth is a flaw in the innovation. The use of limestone-producing bacteria could increase the lifespan of concrete and reduce repair expenditures.


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).
Effect of Carbon Sources on the Production of Microbial Cellulose
Erin Christoph

Microbial cellulose is an organic compound with high polymerization and unique physiochemical properties. Microbial cellulose forms when bacteria feeds on sugar nutrients from a carbon source then spins small fibers which create multiple layers of cellulose on the surface of a liquid culture. When dried, it creates a fabric that has applications in biomedicine, wound dressing, and clothing. The most commonly used carbon source in the production of microbial cellulose is glucose, which yields a high amount of cellulose but is cost prohibited. This experiment tests agricultural waste as a low-to-no cost carbon source in the production of microbial cellulose. Coconut juice, pineapple rind, and oat hay were chosen as the carbon sources while glucose was used as the control. Four cultures each using one carbon source were given a 15-day growing period. The cellulose was weighed individually to determine which carbon source had the highest rate of production. The cellulose made with glucose weighed the most at 6.34g, followed by coconut juice at 5.98g and oat hay at 5.66g, with pineapple rind weighing significantly less at 3.76g. While glucose had the highest rate of production, it was also the most brittle fabric, with coconut juice being the least. Experimentation showed that coconut juice was the most efficient carbon source as it yielded a high rate of production, high tensile strength, and minimal cost. Further research could delve into increasing the water resistance of microbial cellulose to improve applicability in biomedicine and commercial fields.
The Effect of Types of Maglev Track on the Speed of the Train Car  
Riley Dodge, Steven Sosa  

Efficient transportation is important today. It saves time, resources, and the environment. The purpose of this experiment was to study the efficiency of different types of maglev tracks which are EMS and EDS. These were compared to a control which was a single track using magnets for levitation. The independent variable was the types of tracks built and used. The dependent variable was the time that it took for the object posing as a train car to move across 0.3 meters of available track. 15 trails were taken. Due to human error, only the control test track worked properly. The average time it took for the control train to cross 0.3 meters was 0.611 seconds. Since the other two tracks didn’t work, the average for both was 0. The statistical test that was used was the ANOVA test. The outcome p-value was less than 0.0001. The alternative hypothesis was: if an object posing as a train car is pushed down 0.3 meters of model EMS track, then the time would be less than if it were pushed down a model of EDS track. According to the p-value, the stated hypothesis was not supported by the data. Because the two test tracks did not work, it cannot be said that the independent variable affects the dependent variable. The largest problem that occurred with the experiment was the inability to build the EMS and EDS tracks. Possible future research is applying similar maglev principles to automobiles.


Quain, J. (2007). Fast track: With airports and highways more congested than ever, new train technologies have the potential technologies have the potential to resurrect the age of rail. *Popular Mechanics*, 184 (12), 88.


---

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 electric vehicle is stalled by slow charging. This experiment’s goal is to find faster charging technology. If graphene is used as surface material in a supercapacitor, then the energy stored, and energy density will be greater compared to supercapacitors using activated carbon, graphite, or chemical batteries, because the area between the two electrodes will increase allowing for increased static electric charge to form in the supercapacitor storing charge. The independent variable was the material used for the supercapacitor and the dependent variable, milliamp hours (mAh) and mAh per gram. The control is a lithium-ion battery of equivalent voltage. Three supercapacitors were built: activated carbon, graphite, and graphene. After they were built, they were then charged and discharged over a period of time and the mA consumed was measured. The activated carbon supercapacitor held on average 3.447 mAh compared to 1200 for lithium-ion. For the statistical analysis, a T-Test was performed. The graphite was nonfunctional and the graphene was not built due to limitations. The hypothesis was not supported, the lithium-ion is more energy dense and held more charge. The statistical analysis returned a p-value less than 0.0001 which makes the data statistically significant. It is inconclusive if the independent variable influenced the dependent variable because one supercapacitor was tested. The biggest limitation was time. With more time, the other two supercapacitors could be finished and improve results. For further research, an experiment can be done on different thicknesses and types of metals.


Developing a Water Filter Using Electrospun β-lactoglobulin Amyloid Fibrils
Sydney Maloney, Joseph Shangraw

Heavy metals are known to have negative physical and mental health effects on humans. The objective of this experiment is to create a cheaper, more efficient water filter by exploring the new field of protein-based water filters using β-Lactoglobulin (BLG), the most common protein found in milk. The free cysteine group in BLG can bond with heavy metals, which leads to potential applications as a water filter when incorporated into electrospun meshes. For β-Lactoglobulin to have water filtering capabilities, the protein must be denatured into aggregates called amyloid fibrils through heat treatment in an acidic solution, revealing the free cysteine docking stations of the protein that capture the metal ions. The amyloid fibrils are then incorporated into a polyethylene oxide (PEO) solution and are electrospun onto a plastic mesh. Pentaerythritol triacrylate (PETA) is used as a UV induced crosslinker that makes the PEO mesh insoluble. This also supports the mesh by improving mechanical strength and the tensile properties of the mesh. The meshes are then tested by passing samples of water with equal concentrations of copper (ii) ions through the mesh with a vacuum solvent filter. Preliminary testing shows that the aggregated BLG is successful in binding to roughly a third of the copper ions from a solution before being spun into a mesh. Control data shows that close to 11% of copper ions are filtered out by a mesh without BLG. A nonparametric Kruskal-Wallis test is used to determine the difference between the meshes with and without the protein.


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 Natural Aggregates on the Compressive Strength of Concrete
Abeer Siddiqui

Concrete is among the most highly utilized materials in the world. It is essential for building common structures such as roads, bridges, and buildings. However, the cost of producing concrete is rising due to lack of eco-friendly and abundant resources. Utilizing natural aggregates in place of limestone could potentially create more durable and abundant concrete that can be obtained at lower costs. The experiment tested compressive strength (in pascals) of concrete samples that replaced limestone as the conventional aggregate in a concrete composition with natural raw materials such as coconut fiber, rice husks, seashells, and eggshells. Concrete samples with limestone as the aggregate served as the control group.

The compressive strength means were compared by an ANOVA test and determined to be significantly different (p is less than 0.05). T-tests comparing the means of each group showed that compressive strengths were lower for each aggregate in comparison to the control. Within the aggregates, coconut fiber samples had the highest mean compressive strength, followed by rice husks, seashells, and eggshells, respectively. Future research could focus on finding more eco-friendly aggregates that produce lighter concrete to lower albedo, which is radiation reflected by a surface. The aggregate substitutes could be utilized to develop concrete that emits lower rates of carbon dioxide while being produced. Concrete with a high compressive strength that is produced at low costs could be essential for areas affected by natural disasters that need attainable resources to repair buildings and homes and could also be used for low-income housing.


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).
Comparative Analysis of Adhesives  
Steffanie Urbano

When creating an on-the-fly repair business, one of the most important tools for a repairperson is their adhesives. In my field, there is a very narrow selection of glues meeting the high standard to be considered effective. They must be quick, durable, and strong. Even with an experienced-based, expansive knowledge of glues, there are simply too many to fully understand the uses and science behind them. The intent of this research project is to thoroughly analyze and compare different glues used in quick-fix repairs. Therefore, the research purpose of this project is to test various properties and abilities of adhesives to create an index of glues and their levels of effectiveness. Due to the high amount of variability throughout my project and the extensive amount of combinations that could be tested, only specific experiments and situations that will provide usable information will take place. The true goal of this project is to provide practical and usable information that can be used on a day-to-day basis for the average glue user.

Research provides detailed information regarding the chemical makeup of each adhesive. Patents detailed the active ingredients and chemical makeups of most of the glues. Further research revealed how the chemicals found in these adhesives worked and what reactions were caused by the chemistry of the glues. However, there is not much known on how adhesives work on the molecular level. For instance, there are multiple theories on how adhesion takes place like whether it is a chemical or physical connection. The core of this project is based on the difference in the chemistries of each glue and the corresponding effects that result from these chemical differences. More data is being collected and all conclusions will relate to each glue. However, statistical analysis will provide the comparative portion of the adhesive analysis as it will provide information on averages, significance, and the correlation of the results. The product will be an index of data, a part for each glue and another portion comparing all the results. Conclusions will include which glue is suggested for what practice and an overarching conclusion of all adhesives tested. The overall goal is to understand and document a range of fast-acting adhesives.


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).
Second Skin Biodegradable Gel
Maanasa Valluri

Currently, treatments for burn victims range in accordance to urgency of administering the treatment and the severity of the particular burn. However, there is yet a standard treatment to be put in place for hospitals to fit all circumstances that affect the vitality of the burned tissue. The purpose of this experiment is to provide a solution to this problem by creating a biodegradable graft out of a polyacrylamide and agar gel concentration. The versatility of the polyacrylamide combined with the stability of the agar, creates an elastic and robust “second skin” that is easy to preserve for prolonged uses, making it suitable for several circumstances unlike certain organic materials such as the Tilapia Fish Skin, with it’s quick expiration after limited use. It also provides the benefit of allowing several additives such as collagen and antibodies to diffuse through the gel into the skin, like an organic material would be able to do.

The gel is created by combining proportionate concentrations of liquid polyacrylamide, liquid agar together in a gel plate until solidified. Trials afterwards consist of testing the versatility of the gel through oxygen diffusion tests, K12 bacteria prevention tests, and moisture tests. Overall, the results of these tests conclude that the gel works just as effectively as an organic material, with the added benefit of durability and elongated preservation of the material. Evaluating this new burn treatment as a critical advancement compared to other treatments still in use today.


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 Powders on Durability of Plastic Spoon Substitute
Allison Armstrong, Megan Wu

Innovative solutions need to be implemented to reduce plastic waste that is devastating to the environment, such as creating biodegradable spoons as a replacement for plastic. In the experiment, the independent variable was the type of powder used, and the dependent variable was the durability of the spoons created. The control group consisted of spoons made without additional solid. The experiment began with mixing one gram of sodium alginate and 273 milliliters of distilled water, which was then blended with a mixture of five grams of calcium lactate and 100 grams of powder, and poured into a mold where it was left to dry. The spoons were evaluated based on how many pennies they held and how many spoons remained whole. The most durable spoons contained a mixture of 50 grams of potato starch and 50 grams of rice flour. These spoons held the most pennies with a mean of 11.3 compared to the potato starch spoons with 6, the rice flour spoons with 0, the cornstarch spoons with 3, and the control group with 0. The mixed spoons had the second best ratio of unbroken spoons with a mean of 5, compared to the control with 6, the potato starch group with 3.7, the rice flour group with 0, and the cornstarch group with 1. The different solids affected the durability of the spoons as shown by the number of pennies held and number of unbroken spoons compared to the control. The ANOVA test calculated the p-value as less than 0.0001 indicating that the results were significant. In conclusion, the alternative hypothesis that a mixture of potato starch and rice flour would be best is supported. Possible sources of error were that the molds could have been filled differently and that residue remained in the glassware. This possibly impacted the results by altering the spoons’ properties. Further researched could be conducted by asking what other solids could be mixed together to create a better spoon or if there is a coating that helps hold the spoons’ shape longer in liquid.


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 the Environmental and Antibacterial Effects of Biogenically and Chemically Produced Silver Nanoparticles using Danio rerio and Escherichia coli

Megha Yannam

Silver nanoparticles are an emerging technology that have the potential to be used for a variety of functions, including water treatment and consumer products, specifically health supplements, electronics, and skincare products. This experiment compares the cytotoxic and antibacterial effects of silver nanoparticles produced through both chemical and biogenic methods. The cytotoxicity was tested by exposing Danio rerio embryos to nanoparticles and examining hatching rate while the antibacterial effect was tested by using a zone of inhibition procedure on E. coli K-12.

The biogenic nanoparticles were significantly more antibiotic when compared with the chemical nanoparticles (p < 0.05, ANOVA). Both ANOVA and t-tests were used to compare the mean diameters of the zones of inhibition and proved significant (p < 0.05). D. rerio embryos were exposed to solutions containing 0.01 mg/L nanoparticles and a control of conditioned water. The mean hatch rates of the embryos as of 5 days past fertilization were compared between the biogenic and chemical nanoparticles (p < 0.05 ttest). Conclusively, the biogenic nanoparticles had a higher antibacterial effect and a better environmental effect on the embryos than the chemical nanoparticles.

There would need to be further research done on the effects of these nanoparticles when used as a water treatment method specifically and with other organisms. Also, the efficacy of biogenic nanoparticles should be tested as an alternative to chemical nanoparticles. There should also be research done on the effects of nanoparticles on humans, as there is a broad consumer market in which these are 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).
### Microbiology (1700)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1701T10</td>
<td>Akula, Nikhila Edwards, Madeleine</td>
<td>The Effects of Biofilms on Bacterial Cultures</td>
</tr>
<tr>
<td>1702X12</td>
<td>Barthel, Elizabeth</td>
<td>The Effect of Tea Tree Oil on Acne-Causing Bacteria Growth</td>
</tr>
<tr>
<td>1703T12</td>
<td>Bojja, Rashmi Muppala, Rikitha</td>
<td>The Effect of Ayurvedic Remedies on the Inhibition of Enterobacter aerogenes</td>
</tr>
<tr>
<td>1704T12</td>
<td>Cox, Kevin Liu, Isha</td>
<td>Optimizing the Antibacterial Properties of Macroalgae</td>
</tr>
<tr>
<td>1705X12</td>
<td>Gil, Antonio</td>
<td>Effect of Zeolites on <em>Escherichia coli</em> k12 Growth</td>
</tr>
<tr>
<td>1706X12</td>
<td>Hajdo, Peter</td>
<td>The Relationship Between Different Microbiota and Adaptation of <em>Drosophila</em> to High Altitude</td>
</tr>
<tr>
<td>1707X12</td>
<td>Helmann, Ryan</td>
<td>The Survivability of <em>Geobacillus stearothermophilus</em> in Conditions Representative of Saturn’s Moon Enceladus</td>
</tr>
<tr>
<td>1708X12</td>
<td>Hernandez-Figueroa, Kyle</td>
<td>Evaluation of the Antimicrobial Properties of Copper and Zinc Sulfate Infused Textiles</td>
</tr>
<tr>
<td>1709T12</td>
<td>Khushabakht, Areej Niemiec, Natalie</td>
<td>The Effectiveness of Peptide Antibiotics on Eliminating Bacteria</td>
</tr>
<tr>
<td>1710T12</td>
<td>Patel, Dylan Sandhu, Amandeep</td>
<td>A Comparison of Variations of Essential Oils on the Inhibition of K12 <em>Escherichia coli</em></td>
</tr>
<tr>
<td>1711T12</td>
<td>Houston, Emma Vergara, Fadia</td>
<td>The Role of Exosomes on <em>D. discoideum</em> Aggregation</td>
</tr>
<tr>
<td>1712X12</td>
<td>Zelaya-Ballon, Rossana</td>
<td>The Effect of Pipe Material on Biofilm Formation via <em>Vibrio fischeri</em></td>
</tr>
</tbody>
</table>

Category Student Count: 18
Biofilms are complex communities of microorganisms attached to cells. These act as layers that can negatively impact production of good bacteria that helps cells survive and allows multicellular functions to perform. Biofilms cause various illnesses in the body, including immune system problems and serious diseases like cystic fibrosis. This research is imperative because by studying the effects of biofilms, scientists can find ways to control it which will further knowledge and technology in modern medicine. The purpose of the experiment is to observe how bacterial cultures, E. coli K-12, develop the biofilms and in what quantity can they be cultured in a controlled environment. This will allow the observation of how these biofilms affect bacterial cultures. The hypothesis is that if bacteria is introduced to biofilm media, then they will develop a resistance to outside substances. To test the hypothesis, human plasma is used coat the wells in preparation for the incubated E. coli (placed along with more human plasma). Next, different concentrations of both glucose and salt are put into the wells. The wells are then stained with crystal violet and the spectrometer will determine which wells have the highest bacterial growth. The results are still pending and the findings of the experiment are forthcoming.


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 Tea Tree Oil on Acne-Causing Bacteria Growth
Elizabeth Barthel

As research is conducted concerning the effects of unhealthy medications to reduce acne, more people are leaning toward natural remedies including tea tree oil. It has been observed that tea tree oil helps decrease acne. This experiment examines the effects of different quantities of tea tree oil, a natural remedy, on acne-causing bacteria. The width of the zone of inhibition of the bacteria and the amount that the bacteria decreased were dependent on the amount of tea tree oil used, with the control being bacteria that was cultured without the presence of tea tree oil. Bacteria was cultured on petri dishes, then antibiotic sensitivity disks covered in different amounts of tea tree oil were added with fifteen trials each. The bacteria was monitored and measured for zones of inhibition for three days. The bacteria with 50% tea tree oil had the least amount of bacteria growth, averaging 4 mm. A “t-test” analyzed the differences between each group, comparing the zones of inhibition. The mean zone of inhibition for the control was 1.3 mm, for 1% tea tree oil was 1.6 mm, and for 15% was .9 mm. However, results did not support the hypothesis that a greater concentration of tea tree oil inhibits the growth of Staphylococcus epidermis, causing a larger zone of inhibition to occur. A possible source of error could have been contaminated coconut oil used to dilute the tea tree oil. Further research could explore how contaminated oil influences the zone of inhibition of tea tree 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 Ayurvedic Remedies on the Inhibition of Enterobacter aerogenes

Rashmi Bojja, Rikitha Muppala

Crohn’s disease is a chronic inflammatory bowel disease that affects the lining of the digestive tract. It causes symptoms such as fatigue, diarrhea, abdominal pain, and inflammation. Crohn’s disease has a strong correlation to Mycobacterium avium subspecies paratuberculosis (MAP). However, in this experiment, bacteria with properties similar to MAP was utilized: Enterobacter aerogenes, due to the potential safety hazards and environmental restrictions that MAP posed. The purpose of the study is to reinforce the benefits of ayurveda in Crohn's patients and observe improved symptoms. Essentially, this study investigates the effect of ayurvedic medicine (independent variable) or essential oils (cloves, cinnamon, ginger, and turmeric) on the zone of inhibition of E. aerogenes (dependent variable). The data analysis shows statistically significant results as cloves, cinnamon, control, and ginger had a mean inhibition of 17.33 mm, 22.5 mm, 0 mm, and 0 mm respectively. A p-value less than .0001 was calculated, using an ANOVA test, meaning that the variables compared to each other displayed an effect on E. aerogenes growth. The hypothesis, that turmeric would inhibit the most bacterial growth, was rejected. Bacteria grown with turmeric grew an unknown fungus on all trials, prohibiting data collection on that variable. Future research could be to incorporate ayurvedic remedies in a comprehensive treatment plan to alleviate symptoms. However, a comprehensive plan cannot be implemented without definitive research on the root causes of Crohn's. Therefore, a rudimentary aspect of future research on Crohn's should focus on finding causation not just correlation.


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).
Optimizing the Antibacterial Properties of Macroalgae

Kevin Cox, Isha Liu

The development of new alternatives to antibiotics has been necessitated due to the decreased efficiency and resistance of pathogenic bacteria to current medicine. One potential alternative is macroalgae, which have been found to be antibacterial due to the production of secondary metabolites. The antibacterial activity of collected macroalgae has been found to vary between seasons – the cause of which is unknown. Concentration of salt in water has also been correlated with the growth rate, metabolism, and chlorophyll content of macroalgae, all of which may change the presence of antibacterial metabolites in the macroalgae. This research was conducted to attempt to optimize antibacterial activity of macroalgae *Gracilaria tikvahiae*. This was done by determining the effect of the salinity of the water that *G. tikvahiae* was grown in on the antibacterial activity levels of the macroalgae. *G. tikvahiae* was grown at three different salinity levels (20 ppt, 30 ppt, 40 ppt) for two weeks each. A methanol extract was made from dried algal material and a disc diffusion test was performed using the extracts on bacteria *Escherichia coli* and *Bacillus subtilis*. Diameter of the zones of inhibitions were measured using ImageJ. Data collection continues, however if a relationship is found between salinity and antibacterial activity, then the optimal salinity level for maximum antibacterial activity would be known for the creation of future medicines from this macroalgae.


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).
Effect of Zeolites on *Escherichia coli* k12 Growth

Antonio Gil

There are many different types of aqueous environments in which marine animals live. However, these types of habitats can become infected with pathogens over time if water temperatures rise. Pathogens cause infections in a wide spectrum of different types of fish, leading to decreases in populations.

The purpose of this research was to determine whether zeolites could inhibit bacterial pathogen growth. Zeolites have porous structures that absorb chemical and bacterial materials. *Escherichia coli* k12 was cultured prior to being mixed with two different types of water: tap and saltwater. Zeolites were added to petri dishes cultured with bacteria, killing a small ring of bacteria where the zeolites were placed. Water samples of both types containing *Escherichia coli* k12 were then treated with a small dose of natural zeolites. After zeolites were added to the different types of water and were allowed to sit for approximately 72 hours, there was a significant decrease in the bacteria remaining, evidenced by the clarity of the water. Therefore, the addition of zeolites to salt and tap water potentially decreases the amount of bacteria present which increases overall water health. Further research would entail determining whether zeolites were effective in killing other pathogen types. This would lead to a safer environment for most aquatic organisms.


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 Different Microbiota and Adaptation of Drosophila to High Altitude

Peter Hajdo

Gut microbiota have been shown to influence host physiology, including the immune system, behavior, and metabolic processes. In this study, Drosophila melanogaster was used to study the effect of the microbiome (Lactobacillus acidophilus, Lactobacillus gasseri, and Bifidobacterium longum) on adaptation of Drosophila to high altitude.

There were two vials for each of the following groups: Lactobacillus acidophilus, Lactobacillus gasseri, Bifidobacterium longum, and no added bacteria. One vial from each group was kept in a vacuum chamber at the equivalent of about 3000 meters in altitude, and the other vial was kept at sea level. When the Drosophila layed eggs, larvae were counted and a sample of 10 flies was taken from each vial for pictures. Measurements include eye color, body color, number of larvae, and wing size.

No changes have been observed. Further research could include gene sequencing in order to identify more specific variations between groups over more generations.


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 Survivability of Geobacillus stearothermophilus in Conditions Representative of Saturn’s Moon Enceladus
Ryan Helmann

Enceladus, Saturn’s moon, may be key in discovering the existence of alien life in the solar system. The National Aeronautics and Space Administration (NASA) classifies this moon as one of three likely celestial bodies to support life due to the presence of a large liquid water ocean, evidence of simple organic compounds, and possible internal heat sources at the bottom of the ocean. The purpose of this research was to determine whether the bacterium Geobacillus stearothermophilus could survive conditions similar to those found on Enceladus. Bacteria were cultured in temperatures and pH levels similar to those expected on Enceladus and bacterial growth was recorded.

Groups exposed to Enceladus-like conditions of a pH of 11 and the hydrothermal vent-like temperatures of 75 degrees Celsius grew similarly to the control group, which experienced optimal growth conditions for this extremophilic bacterium. Control conditions had temperatures of 50 degrees Celsius and a pH of 7.3. Statistical analysis indicated growth differences between groups was not significant. These results support the hypothesis that these bacteria would survive conditions similar to Enceladus.

Further research of Enceladus should be focused on other species of extremophilic bacteria capable of withstanding harsh environments. Potential candidates may be methanogens, due to their ability to survive hydrothermal vents and to fix methane as their carbon source. These results should encourage the National Aeronautics and Space Administration (NASA) that discovering life on other celestial bodies could potentially be achieved in only a few decades, as NASA previously proposed an Enceladus Life Finder mission.

Dunford, B. 2016. Enceladus: Overview. National Aeronautics and Space Administration. Available online at: https://solarsystem.nasa.gov/planets/enceladus#


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).
Evaluation of the Antimicrobial Properties of Copper and Zinc Sulfate Infused Textiles

Kyle Hernandez-Figueroa

The overuse of antibiotics has led to the increase of antibiotic resistant bacteria that are the cause of a number of incurable or hard to treat infections such as MRSA. Certain metals kill bacteria on contact and their use may show promise in limiting the chance of infection without fostering resistance. The goal of this research was to determine whether the antimicrobial copper and zinc could be effectively infused into fabrics which could be used as hospital scrubs. Fabric was soaked in 1M, .75M, .5M, and .25M solutions to determine what strength of zinc sulfate monohydrate or copper sulfate pentahydrate was effective at killing Escherichia coli K12.

Results showed that the treated fabrics harbored consistently lower numbers of bacteria than did the nontreated control. The copper sulfate treatment was most effective in preventing bacterial growth at the 1M strength as evidenced by an average 40.7% less colony growth from the control, while the zinc sulfate treatments resulted in 50-55% bacterial growth. Samples that were left open to environmental exposure instead of being purposely infected displayed almost no bacterial growth in comparison to uninfected controls. Additional research includes engineering a method of getting chemicals to stay embedded in the fabric after washes and making a layered piece of clothing to protect a wearer from skin irritation. The use of such antimicrobial chemicals in everyday applications can result in a more sanitary clinical environment and reduce the likelihood of spreading infections.


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 Effectiveness of Peptide Antibiotics on Eliminating Bacteria
Areej Khushabakht, Natalie Niemiec

Antibiotic-resistant bacteria are becoming an increasingly relevant problem throughout the medical world. The purpose of this experiment is to test the effectiveness of peptide antibiotics versus regular antibiotics on *Escherichia Coli* (*E. Coli*) samples are exposed to the antibiotics, *Kanamycin A*, *Ampicillin*, and a peptide antibiotics. The experiment was made to compare the sizes of the zones of inhibition of each different antibiotic. The growth of the zone of inhibition was measured on days 1, 2, 7, and 8, the results were recorded in millimeters, each variable had 15 trials. Contrary to the hypothesis, the results dictate that *Kanamycin A* was the most effective in treating the *E. Coli* and the peptide antibiotic was the least effective. *Kanamycin A* was most likely the most successful because it is the current most widely used treatment for *E. Coli*. When compared to the other antibiotics the peptide antibiotic was the least successful but there was a slight growth of the inhibition zone by day 7. Results show the rapid formation of antibiotic resistance in the *E. Coli*, in relation to *Kanamycin A*, and *Ampicillin* because both had regrowth of the bacteria within the inhibition zone by day 7. The largest question drawn from this experiment was; is there a specific peptide antibiotic that could be used to treat *E. Coli* more effectively? Since the peptide used is known most commonly to treat symptoms associated with diabetes, conducting another experiment with the use of another peptide antibiotic, could provide more effective results.


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 Variations of Essential Oils on the Inhibition of K12 Escherichia coli
Dylan Patel, Amandeep Sandhu

Essential oils are naturally occurring compounds found in plant parts. The rise of antibiotic resistance and the fact essential oils have various antibacterial properties and neurological effects have led to interest in their use as an alternative to traditional antibiotics. Pharmaceutical antibiotics kill harmful and beneficial bacteria in one's body, contributing to unwanted side effects. This concern prompted this investigation which tested differing variations of essential oils and a commonly used antibiotic to compare their efficacy on the inhibition of bacterial growth. Thirty nutrient agar plates were inoculated with K12 E. coli. After inoculation, a filter paper disc was saturated with 3 ml of essential oil variation. Two variations of essential oil(s) had a higher average radius for their zones of inhibition than the control of the experiment, the triple antibiotic ointment. Our experiment indicated the most effective blend was *Thymus serpyllum* and *Mentha piperita* with a significantly larger zone of inhibition. The significance of this experiment is the possible impact that essential oils can have on the suppression of bacteria resulting in the need for decreased use of traditional antibiotics. Further experimentation should strengthen the argument for essential oils as a viable option for primary medicine.


Noble, E. Natural Alternatives to 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 Role of Exosomes on D. discoideum Aggregation
Emma Houston, Fadia Vergara

Exosomes are extracellular vesicles released by cells and have been recently linked to various functions including intercellular communication. Exosomes can be composed of mRNA, miRNA, DNA, proteins, or other compounds. When starved, the unicellular protist, Dictyostelium discoideum, signal cells to aggregate forming a multicellular fruiting body. D. discoideum was used as a model organism to test the role of secreted exosomes on cell aggregation. D. discoideum was inoculated on six plates using non-nutrient agar with E. coli K12. Exosomes were collected from the three donors plates after 48 hours, using standard extraction procedures, and placed on the three young plates, grown for 32 hours, using filter paper disks. Each young plate had two disks with extracted exosomes and two disks with sterile PBS equidistant from the center. The fruiting bodies within a 1.2 cm range of each disk were counted; statistical analysis has shown a significant difference between the exosomes group and the PBS group with a P-value < 0.001 (chi-squared test).

Based on this analysis, exosomes show a significant effect on increased cell aggregation shown by an increase in the number of fruiting bodies. This provides evidence that exosomes have functional effects on recipient cells. Further research can be done on the composition and quantity of exosomes that are released by D. discoideum and other organisms. Exploration of the functional effects and properties of exosomes can aid in the research of exosome therapy for cancer treatment. With a greater knowledge of how cells communicate, there will be a better understanding cell signaling during cancer.


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 Pipe Material on Biofilm Formation via Vibrio fischeri
Rossana Zelaya-Ballon

Water is a natural resource that covers three-fifths of the Earth and compromises nearly 70 percent of the human body. In some cases, water is an enemy as it is a leading cause of many natural disasters where it leads to the destruction of pipelines which causes clean water to mix with unsanitary water. As a result, microorganisms that form biofilms make their way into communities contaminating their water with harmful bacteria.

The intent of this research was to determine which pipe material was best suited to inhibit the growth of pathogenic bacteria. Five different types of pipes, polyvinyl chloride (PVC) pipe, chlorinated polyvinyl chloride (CPVC) pipe, cross-linked polyethylene (PEX) pipe, copper pipe, galvanized steel pipe, were submerged in Vibrio fischeri cultures and biofilms allowed to form. The degree to which films were made on pipes was determined via an ultraviolet light since Vibrio fischeri is bioluminescent.

The pipes showed clear evidence of film formation. Galvanized steel pipes experienced the greatest degree of biofilm formation, while PVC displayed little formation. All types of material experienced some degree of biofilm formation. It is the recommendation that PVC pipes, while they may not be as structurally sturdy as galvanized steel, be used to transport drinking water in communities where water sanitation is an issue. Further research would entail testing biofilm formation by pathogenic bacterial species. Minimizing the number of waterborne diseases which usually result from the destruction pipelines due to natural disaster is of great importance in improving global health.

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, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1801X12</td>
<td>Conrow, Elijah</td>
<td>Properties of Diffusion in Fluid Undergoing Magnetohydrodynamically Induced Rotational Flow</td>
</tr>
<tr>
<td>1802X12</td>
<td>Hosten, Taylor</td>
<td>The Effect of Salt on the Diffraction and Refraction of Laser Light</td>
</tr>
<tr>
<td>1803X12</td>
<td>Kamal, Nailah</td>
<td>Determination of the Existence of Ratios that Explain the General Location of Planets in the Galaxy</td>
</tr>
<tr>
<td>1804X12</td>
<td>Kinney, Yaiza</td>
<td>The Effect of the Angle of the Arm in Breaststroke on the Propulsion Force Generated</td>
</tr>
<tr>
<td>1805X12</td>
<td>Kudum, Rasvik</td>
<td>Modelling the Effect of Three-Body EMRI Systems on Resultant Gravitational Waveforms</td>
</tr>
<tr>
<td>1806X12</td>
<td>Pimentel, Julia</td>
<td>The Construction and Operation of a Portable Small-Scale Radio Telescope to Collect Electromagnetic Signals Emitted from Space</td>
</tr>
<tr>
<td>1807T12</td>
<td>Kozlowski, Kaden Smith, Lydia</td>
<td>Football Hits: How Hard are they Really?</td>
</tr>
<tr>
<td>1808X12</td>
<td>Stillman, Carson</td>
<td>Mimicking Quantum Double-Slit Phenomena using Sound Waves and Linseed Oil</td>
</tr>
</tbody>
</table>

Category Student Count: 9
Properties of Diffusion in Fluid Undergoing Magnetohydrodynamically Induced Rotational Flow

Elijah Conrow

Characterizing the diffusion of particles through any specified medium is often useful for understanding the impacts of said medium upon its surroundings, and is especially suitable in the context of analyzing the environmental impacts of new technologies in the realm of hydraulics. Specifically, this experiment endeavours to characterize the type of diffusion - that is, either sub-diffusion, normal diffusion, or super-diffusion - that occurs in a fluid being actively mixed by magnetohydrodynamic effects resulting from the simultaneous presence of a magnetic field and electric current. Using salt water as the experimental medium allows for an extrapolative hypothesis regarding the characterization of diffusion in potential magnetohydrodynamic propulsion systems to be justified, and additionally provides a basis towards understanding diffusive processes in more profoundly magnetohydrodynamic systems, such as plasma. Data collection is ongoing due to the need to determine if the characterization of diffusion generalizes to multiple magnetic field shapes, or if even modestly more complicated magnetic fields modify the type of diffusion occurring; in either case, useful information will have been obtained about the sensitivity of stochastic particle motion through magnetohydrodynamic systems.


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 on the Diffraction and Refraction of Laser Light

Taylor Hosten

The use of laser light is becoming more prevalent in everyday life. Its use entered via the cosmetic surgery field and its continued use is increasingly commonplace in the medical field. In additional, research using laser light in murky water in order to find objects and missing persons has shown that the light narrows and precision increases, allowing it to shine farther through the water.

The purpose of this research was to determine whether, the refraction of laser light would decrease through different substances, such as salt water. If the refraction of light through the water containing salt decreased, then lasers may prove useful in the location of people during drownings. A laser pointer and a neon laser was shone through water containing salt particles. Laser precision was determined by measuring the degree of distortion and the distance at which the greatest precision existed. Statistical analysis was conducted and the null hypothesis was rejected, as the precision of laser light increased due to the presence of particles.


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 the Existence of Ratios that Explain the General Location of Planets in the Galaxy

Nailah Kamal

Planetary bodies are located such vast distances from each other that it is almost impossible to understand these object’s dynamics. Yet, scientists and philosophers have long tried to understand how the universe interacts. Mapping the universe and location of celestial bodies in general is a modern phenomenon. Scientists have only surveyed a small fraction of space.

The purpose of the research was to gain a better understanding of the universe and location of celestial bodies with the hope that perhaps new bodies could be located. Three different ratios were calculated and compared to the surface gravity, orbital distance, density, and volume of moons and their subsequent planets.

It was found that there is a 1: 5176 ratio between distance and surface gravity of subsequent planet, a 1: 136090 ratio between distance and density, and a 1: 9 * 10^-11 ratio between distance and volume. These ratios were then employed when analyzing photographs of space to determine whether they were useful in locating undiscovered planets. Using planet Jupiter as an example, the calculations were able to locate its moons Europa, Ganymede, and Io.

Further research would investigate into the gravitational aspects of planetary objects. More specifically, research should focus on the characteristics of meteors and their locations in order to attain additional data regarding the relationship between distance and different measurements of celestial objects. There may exist a pattern in the arrangement of planetary bodies in the solar system that could potentially help to predict the location of others.


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 Angle of the Arm in Breaststroke on the Propulsion Force Generated 
Yaiza Kinney

Due to improvements in research and progressions in motion-capture technology, the sport of swimming has experienced enormous advances in the understanding of the effects of propulsion and drag on a human body in motion. However, research has been limited to only one of the four competitive strokes: freestyle. This research is an attempt to measure how the angle of the arm in breaststroke pull affects the propulsion force of a swimmer. In the swimming world, there are two distinct types of breaststroke pull: one with an emphasis on a higher 45 degree angle during the pull and one with a lower 30 degree angle during the pull.

It was hypothesised that the closer the angle was to 90 degrees, the more propulsion force generated by the pull. The experiment was conducted at a local pool and participants were tied to a tether that was attached to a force sensor that measured the tension of the tether in Newtons. The participants held a steady kick for 30 seconds and held a position at the 0, 30, 45, and 90 degree mark. Data collection is currently ongoing, but preliminary tests indicate that the maximum force generated occurs between the 30 degree and 45 degree angles. Further trials and research on the hydrodynamics of breaststroke will increase understanding of the sport and further maximize the efficiency of the stroke.


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).
Modelling the Effect of Three-Body EMRI Systems on Resultant Gravitational Waveforms
Rasvik Kudum

Gravitational waves are ripples in the curvature of spacetime that move at the speed of light. One of the best known sources of gravitational waves are extreme mass ratio inspirals (EMRI). Interest in these systems originates mainly from the fact that the gravitational waves produced encode many characteristics of the structures from which they formed. The area of physics devoted to characterizing EMRI's is quite new, and only a small subset of the many possible EMRI types have been studied. A protocol for distinguishing binary and tertiary EMRI's has not been developed at this time. Thus, the author intends to model three-body resonant EMRI systems and analyze their gravitational waveforms. To this end, the author has created a simulator that finds numerical solutions to multi-body orbit problems, through the use of Runge-Kutta 4, and outputs relevant gravitational waveforms. The generated three-body waveforms will be compared to generated two-body waveforms, through the use of the fitting 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 Construction and Operation of a Portable Small-Scale Radio Telescope to Collect Electromagnetic Signals Emitted from Space  
Julia Pimentel

Since the majority of the vast universe is unable to be seen with the naked eye, scientific instruments are used to map astronomical objects and extraterrestrial phenomena in space. Such bodies produce radio emissions, characterized by their long wavelengths registered beyond the spectrum of visible light. Radio telescopes collect these signals, thereby enabling the study of the presence of planets, stars, and other marvels throughout the interstellar medium.

A small-scale portable radio telescope was constructed to detect radio emissions from various points in the sky. In contrast with typical radio telescopes, this project applied the principles of up-cycling and cost-effective construction to build a usable, more affordable telescope. The engineering purpose of this project was two-fold: to design a fully operating radio telescope and to analyze the amplified signals collected from the radio receiver. A reflective hexagonal dish and a complex of cords, dongles, and amplifiers were fastened together during construction. To make the structure portable, the telescope was assembled to compact conveniently. After the telescope was calibrated, the baseline was used to analyze future signals. The graphs produced by the GNU radio companion program displayed signal peaks when the telescope was pointed towards a source of waves, with one hydrogen source determined to be the sun at a frequency of 1.4e+09 Hz. Further research entails the testing of electronic parts to increase telescope sensitivity and to detect a variety of compounds in addition to hydrogen. Such research allows the average citizen to capture emissions from space.


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).
Our project aims at understanding the risk of concussion in high school football players. We know concussions are traumatic head injuries that can have severe long-term effects to athletes, but we don’t know how commonly concussions occur in high-impact sports where head trauma occurs enough to be disregarded. We attended two high school football games, obtaining data on forces associated throughout normal game play by using a radar gun positioned along the fence line to measure the maximum velocity over three seconds. The average mass of the team was recorded using the online roster. We calculated the impulse of players to analyze the potential for concussion. We considered, based upon research and accepted standards, a force of 213.5 N as the concussion threshold, which we calculated using the momentum of our average mass, multiplied by 7 m/s, over a time of three seconds. We determined that 21.7% of recorded running plays put players at risk. Stricter rules on game play could lower this risk. Further studies in the area could monitor the difference between JV and Varsity athletes, and whether the level of play (regular season vs. playoffs) affects concussion-level hits. Further studies could be done on passing plays, since we were only able to monitor running plays. The NFL has historically been very unreceptive to concussion studies, but testing the rate of concussion-level hits at the professional level would be very useful when determining how best to prevent these head injuries.


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).
Mimicking Quantum Double-Slit Phenomena using Sound Waves and Linseed Oil

Carson Stillman

There are many competing quantum mechanical theories on the behavior of particles including the de Broglie-Bohm interpretation, also called pilot-wave theory. This theory holds that at all times particles have a definite position in space and are guided in their movement by a so-called pilot wave. This wave accounts for randomness particles appear to exhibit and accounts for many of their wave-like properties. This study was to provide a macroscopic framework for how pilot-wave theory could function in the double slit experiment, which showed particles behave like waves at the atomic level. A speaker was vibrated at a frequency of 80 Hz sine wave, and four 3-d printed petri dishes, one containing no slit, one with a single slit, and two with double slits placed at varying distances from each other were filled with linseed oil and attached to the top of the speaker. A wooden splint was used to create droplets of linseed oil, which became self-propelling because of the vibration of the speaker. The motion of these droplets was then tracked and the horizontal displacement of the drops recorded. Preliminarily, the data is indicative of the trademark interference pattern seen in the classical double slit experiment. Several peaks and troughs were expected to be observed, and these are clearly seen in early test results. The largest percentage of the drops were observed in the middle of the dish. Further research could include close observation and study of the waves guiding the oil drops.

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).
### Plant Sciences (1900)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1901X12</td>
<td>Dean, Ashley</td>
<td>How Does Fluctuating Sounds affect the Photosynthesis Rate in Plants</td>
</tr>
<tr>
<td>1902X12</td>
<td>Eda, Ritika</td>
<td>The Effects of Various Temperatures on the Size of Xylem (Data Ongoing)</td>
</tr>
<tr>
<td>1903T12</td>
<td>Chong, Ryan, Farooq, Amaar</td>
<td>Remediating Alliara petiolata Affected Soil With Arbuscular Mycorrhizal Fungi</td>
</tr>
<tr>
<td>1904X12</td>
<td>Haley, Shelby</td>
<td>The Effect of Purple Light on Brassica rapa</td>
</tr>
<tr>
<td>1905X12</td>
<td>Hill, Kaitlin</td>
<td>Symbiotic Relationship Aids Growth in High Geothermal Conditions</td>
</tr>
<tr>
<td>1906T12</td>
<td>Chavvakula, Satya, Indupuru, Vijayalakshmi</td>
<td>Homemade Hydroponic System VS. Commercial Hydroponic System</td>
</tr>
<tr>
<td>1907X12</td>
<td>Klein, Alexander</td>
<td>Finding the Optimal Combination of Essential Oils Extracted From Thymus vulgaris and Menta menthe x piperita to Deter Drosophila suzukii From Attractive Stimuli</td>
</tr>
<tr>
<td>1908T12</td>
<td>Maheshwari, Saarthak, Srinivasan, Kirthana</td>
<td>Increasing HPV-35 Antigen Production in Transgenic Nicotiana benthamiana Through Multiple Agrobacterium Transformation Techniques</td>
</tr>
<tr>
<td>1909T12</td>
<td>Niemann, Anastasia</td>
<td>The Effect of Temperature on Zooxanthellae to Prevent Coral Bleaching</td>
</tr>
<tr>
<td>1910T12</td>
<td>Shah, Ria</td>
<td>The Efficacy of a Combination of Arbuscular Mycorrhizal Fungi as a Potential Biocontrol Method for Meloidogyne incognita in Peas (Pisum sativum L. cv. Green Arrow)</td>
</tr>
<tr>
<td>1911X12</td>
<td>Smith, Margaret</td>
<td>The Efficacy of a Combination of Arbuscular Mycorrhizal Fungi as a Potential Biocontrol Method for Meloidogyne incognita in Peas (Pisum sativum L. cv. Green Arrow)</td>
</tr>
<tr>
<td>1912X12</td>
<td>Warner, Jordan</td>
<td>The Effect of Neonicotinoid Pesticide Application Method on the Photosynthetic Rate of Supertunias</td>
</tr>
<tr>
<td>1913X12</td>
<td>Wells, Brett</td>
<td>The Efficacy of Cricket Meal as an Alternative Fertilizer to Fight World Hunger</td>
</tr>
<tr>
<td>1914X12</td>
<td>Ziemann, Jacob</td>
<td>The Effect of B-Nine on Photosynthetic Rates</td>
</tr>
</tbody>
</table>

Category Student Count: 17
How Does Fluctuating Sounds affect the Photosynthesis Rate in Plants
Ashley Dean

Frequency and pitch have a relationship between each other, as frequency is high, pitch is high and as frequency is low, pitch is low, therefore frequency and pitch are the same. Plants are naturally exposed to sounds in their environment, in this case, fluctuating sounds (natural sounds) such as bees buzzing, rain & thunder, and birds chirping, create differing pitches within the sound itself. The frequency doesn’t remain on a constant note, but rather alters as the sound is played.

By using three different plants leaves, Dracaena deremensis, Adiantum hispidulum, Schefflera elegantissima, and exposing them to three different fluctuating sounds each for a time lapse of 30 minutes, the CO2 uptake levels should increase when the frequency of the sounds are low. The photosynthesis rate is being measured by monitoring the CO2 uptake, therefore, it’s possible to tell whether the plant is able to grow under a specific frequency level based off the CO2 uptake level readings.

The Effects of Various Temperatures on the Size of Xylem (Data Ongoing)

Ritika Eda

Water transport in vascular plants depends upon the conductance of the xylem system, which is influenced by the anatomical properties of the xylem vessels such as diameter and length. Understanding xylem can help discover more efficient ways to prevent water loss caused by excessive transpiration. This study investigates the effects of various temperatures on the size of the xylem vessels within the stem of Zonal Geranium flowers. Three plants were tested. One plant in each environment: under a heat lamp (Plant 1), and in a garage (Plant 2), and room temperature (Plan 3). Every day, each plant was given blue dyed water. After 12 days, the stem of each plant will be cut to examine the xylem size under a microscope. Currently, 9 days have passed. Plant 1 has decreased in stem size (Day 1 circumference: 2.81cm, Day 9 circumference: 2.00cm). Plant 2 has increased in stem size (D1: 2.62cm, D9: 2.98cm). Plant 3 has also increased in stem size (D1: 3.61cm, D9: 3.92cm). I am expecting the xylem to be affected in the way as the stem circumference, circumference increases, xylem increases, and vice versa. I will compare the xylem diameter using a chi-square test, which will test how well the observed distribution of data fits with the distribution that is expected.


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).
**Remediating Alliara petiolata Affected Soil With Arbuscular Mycorrhizal Fungi**  
Ryan Chong, Amaar Farooq

Alliara petiolata is an invasive plant species in North America that outcompetes native plant species through the secretion of allelopathic chemicals. These chemicals are released into the rhizosphere and inhibit the growth by reducing the quantity of beneficially symbiotic mycorrhizal fungi in the soil which helps the native plant species get necessary nutrients. When this relationship is lost, it reduces the ability to compete with A. petiolata.

In order to determine the effect on the amount of mycorrhizal fungi in A. petiolata affected soils, 0.0g, 0.1g, 0.2g, and 0.3g of mycorrhizal fungi inoculant will be mixed into separate tray cells of Viola tricolor plants with A. petiolata affected soil. The amount of mycorrhizal fungi in the roots of the V. tricolor plants will be observed by staining the fungi, and the measurement will be observed and compared with the control group. In addition, biomasses will be compared among the plants. Data is pending.


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 - 2018**

<table>
<thead>
<tr>
<th>The Effect of Purple Light on Brassica rapa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelby Haley</td>
</tr>
</tbody>
</table>

In the horticulture industry there is a surplus of light research on plant growth. However, there is little research on the effect of purple light wavelength on plant growth. The goal of this experiment was to study the effect of purple light wavelength on the biomass of *Brassica rapa*, a Wisconsin fast track plant. Sixty pots (two plants per pot) of *Brassica rapa* were grown: 20 in the control group grown under full spectrum grow lights; 20 under grow lights and purple LED lights; and 20 under purple LED lights alone. After 25 days from sowing seeds, plant biomass was harvested. Data indicated that the most biomass was found in the plants that were grown under grow lights and purple LED lights. The average biomass in the control was .8235gm; in the grow light and purple light group was 17.5 gm; and in the purple light group was 3.9gm. These results did not support the hypothesis that purple light would produce plants with the greatest biomass. Additional trials are needed to confirm the validity of these results. Further research that measures different ways that plant growth can be impacted by purple light would 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).
Symbiotic Relationship Aids Growth in High Geothermal Conditions
Kaitlin Hill

In Yellowstone National Park there is a grass, Dichanthelium lanuginosum, that grows in geothermal conditions up to 65°C. It is able to do this because of a symbiotic relationship between itself and a fungus, Curvularia protuberata, that enables thermal tolerance in the plant. Previous research has shown that the fungus by itself is not thermal tolerant, it only has those properties when it is grown with the Dichanthelium lanuginosum. The question that was investigated was; is it possible to grow other plants, specifically crops, with the fungus, Curvularia protuberata, so that they will be thermal tolerant. Figuring that if the data proved significant, then it would be possible to grow crops in higher temperatures than they already are so that more food could be produced to feed more people globally.

Initially, Curvularia protuberata was going to be used but proved difficult to procure, and a substitute fungus had to be ordered, a Phycomyces plate culture. Three different plants were tested, the grass (Dichanthelium lanuginosum), tomato (Solanum lycopersicon), and spinach (Spinacia oleracea) at three different temperatures 22°C, 30°C, and 45°C. Heated plant beds were used to simulate geothermal conditions. Each of the three different species of plant was randomly split in half, with one half being inoculated with the fungus and the other half not. Then each of those six groups was split into thirds to be grown at the three temperatures. At this time testing is not finished, so no conclusion can be made.


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).
Homemade Hydroponic System VS. Commercial Hydroponic System
Satya Chavvakula, Vijayalakshmi Indupuru

Hydroponic systems are a great way to grow plants quickly and efficiently. However, current commercial hydroponic systems are expensive. The goal was to develop an alternative, homemade hydroponic system that would cost significantly less but yield similar results. A 11 plant hydroponic system found on Amazon would cost about $60, whereas a homemade one will cost roughly half of that. Using common materials found in a hardware store, a simple Nutrient Film Hydroponic system was constructed. Water containing nutrients was funneled through two pipes containing the plants to keep cycling fresh nutrients to the roots of the plant. With cost in mind, the homemade system can grow up to 10 plants compared to the commercial systems 11 plants. The plant *Trigonella foenum-graecum* was grown to measure the effectiveness of the systems. With current data, it appears the commercial hydroponic system has no statistically significant advantage when measuring plant height. The experiment continues to be conducted and data is still being collected. By finding ways to bring down effective costs of hydroponic systems, they will become more popular and effective.


/*We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. /*We also attest that the above properly reflects my/our own work (digitally signed).*/
Finding the Optimal Combination of Essential Oils Extracted From Thymus vulgaris and Menta menthe x piperita to Deter Drosophila suzukii From Attractive Stimuli

Alexander Klein

The objective of this experiment is to identify the optimal combination of essential oils from Thymus vulgaris and Menta menthe x piperita to deter Drosophila suzukii from attractive stimuli. D. suzukii are an invasive species of fruit fly that oviposit into fresh fruits, causing premature rotting and hundreds of millions of dollars’ worth of crop lost annually (Pham & Ray, 2015). Thyme and peppermint essential oils have been shown to individually deter D. suzukii from fungi, however no studies have been done on their synergistic effect as fly deterrents (Gallucci et al., 2009). This research focused on combining the essential oils in varying ratios to deter D. suzukii from an attractive stimulant (raspberry juice) in the search of a synergistic effect. Flies were placed in a tank with two wicks, both with combinations of thyme and peppermint oils. The total amount of time that the fly came into contact with the wick was measured for thirty minutes. Data collection continues, however preliminary data shows that not only are the oils acting as deterrents, but they may also be acting as fumigants. The topic being investigated is very important to research because essential oils are a promising natural alternative to insecticides. Also, essential oils can possibly inhibit the presence of Drosophila suzukii in postharvest fruit. This would decrease the amount of food lost each year, increase the profits of producers and sellers, and increase the total amount of fruit available to the public.


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).
Increasing HPV-35 Antigen Production in Transgenic Nicotiana benthamiana Through Multiple Agrobacterium Transformation Techniques  
Saarthak Maheshwari, Kirthana Srinivasan

Vaccines are a cornerstone in providing sustained immune protection for humans. Vaccines can be produced using transgenic plants as the source for amplified viral antigens, and can be used to express viral epitopes and bacterial toxin subunits. The goal of this research is to increase the efficiency of transient antigen production within Nicotiana benthamiana, via various combinations of sonication, syringe infiltration, vacuum infiltration, and desiccation, in combination with Agrobacterium-mediated transformation, to create a commercially-sound transformation system.

To test the efficacy of the concept, transformation techniques of Agrobacterium with the pGLO plasmid (with GFP genes) will be tested in four experimental and four control groups combining the various techniques. The procedures will be retested using a nonpathogenic HPV-35 plasmid to produce viral antigens. Sonication transformation will occur by placing leaf samples and a solution of transformed Agrobacterium into a sonifier, resulting in non-lethal microwounding of tissue. In vacuum infiltration, the negative atmospheric pressure would remove interstitial air, allowing discharged Agrobacterium media to enter. In syringe agroinfiltration, the Agrobacterium mixture is injected through the epidermis. The plants will also be placed in a desiccating environment to extract excess moisture. Results are pending. The results will be acquired via a non-quantitative PCR test and an ELISA test to detect the presence of HPV-35 antigen, to determine the efficiency of transient HPV-35 antigen production. Further research would entail creating a thermally stable vaccine using these Agrobacterium transformation techniques.


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 Zooxanthellae to Prevent Coral Bleaching

Anastasia Niemann

Zooxanthellae and coral share a symbiotic relationship; however, they dissociate when water temperatures rise. This dissociating causes coral bleaching. The average sea surface temperature for coral inhabiting waters is ~21°C; recently, the highest the surface temperature has gotten is ~35°C. This is well above the average, and when temperatures reach this level, even for a few hours, zooxanthellae die and the coral bleaches. Using selective breeding, the zooxanthellae can survive in temperatures above 35°C.

In two tanks the zooxanthellae were selectively bred by raising their water temperature for multiple hours, then bringing the temperature back to a comfortable level. This process was executed until the zooxanthellae reached a temperature at which they could no longer survive. The zooxanthellae were successfully bred to survive in 39°C water, however, they could not reach a temperature higher than 39°C. This was compared to a control tank in which the zooxanthellae were exposed to an increase in temperature, without being brought back down to a comfortable temperature to re-grow. This was done to show how the highest temperature the zooxanthellae could normally survive. These zooxanthellae showed a steady decrease in life as the temperatures were raised, and the all the algae were dead at the end of the 35°C trial. Using a statistical T-test, the p-value was zero, showing there is a significant difference between the zooxanthellae being selectively bred and the normal zooxanthellae. The selectively bred zooxanthellae can survive a much higher temperature than the normal zooxanthellae.


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 Starch Accumulation in Lab Grown vs. Natural Grown Common Duckweed (Lemna Minor)

Ria Shah

The dependence on petroleum, fuel and other oil-based materials for energy has made the world look for alternative, sustainable and cleaner sources of energy. Duckweed, a small aquatic flowering monocot, is considered an invasive species, but it can produce fuel through the ethanol the plant produces. Because duckweed’s products were not previously used in the market, looking for cleaner sources of fuel introduced duckweed into the industry. Due to its rapid growth and reproduction rate as well as its high starch levels, duckweed produces a high yield of ethanol, allowing for a cleaner biofuel. Currently, scientists have yet to cultivate masses of duckweed in laboratory conditions. This experiment investigates starch levels in laboratory grown duckweed compared to starch levels in natural grown duckweed. While data agreed with the hypothesis, the difference between laboratory conditions and natural conditions grown at an optimum temperature was significantly smaller than expected. The significance of these results could impact the manner in which duckweed is produced. If scientists can cultivate masses of duckweed in a controlled environment, it would make the extraction and fermentation of starch easier and more efficient, pushing duckweed biofuel products into the market.


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 a Combination of Arbuscular Mycorrhizal Fungi as a Potential Biocontrol Method for Meloidogyne incognita in Peas (Pisum sativum L. cv. Green Arrow)

Margaret Smith

Root-knot nematodes (RKN) cause millions of dollars of crop damage each year and without effective management threaten global food security. RKNs are plant-parasitic nematodes that damage plants by entering the roots and feeding off the vascular cells. Numerous studies find arbuscular mycorrhizal fungi (AMF) reduces the amount of RKNs that infect plants in RKN infested soil. This investigation aims to determine if AMF is an effective biocontrol agent for the RKN Meloidogyne incognita in peas (Pisum sativum L. cv. Green Arrow). Three groups of peas were inoculated with AMF, RKNs, and AMF + RKNs, respectively. An additional group of peas was not inoculated and served as a control. Every five days plant height was measured. After 70 days the plants were uprooted and root length and stem diameter were measured. Degree of nematode galling was assessed on a scale of one to six, one being minimal galling and six being extensive galling. Nematode eggs per plant were also counted. Although data is still being collected I anticipate the RKN and AMF condition will have fewer RKN eggs and galls and a larger average root length and stem diameter than the RKN condition. Additionally the AMF condition should have a larger average root length and stem diameter than the control since AMF expands root morphology thus increasing nutrient uptake. These results would indicate that AMF is somewhat effective as a biocontrol agent for RKNs in peas. Further research should explore combinations of AMF and other RKN management strategies.


The Effect of Neonicotinoid Pesticide Application Method on the Photosynthetic Rate of Supertunias

Jordan Warner

Neonicotinoid pesticides are one of the most common and effective pesticides for controlling insects. This specific pesticide targets insects that are known to suck and pierce leaves. Neonicotinoid pesticides, such as imidacloprid, have a chemical action that can be described as translaminar, being absorbed into the plant cuticle. From there the chemical moves into the xylem of the plant and into the other systems of the plant that pests are most likely to feed on. Chemical action of imidacloprid causes nicotine to bind to nACHrS (nicotinic acetylcholine receptors) that are located in the central nervous system in the pests. This experiment compared application methods (foliar spray vs drench) of imidacloprid on photosynthetic rate. Ninety pots of Royal Velvet supertunias were tested: 30 in the control which received no treatment; 30 in the foliar application group; and 30 in the drench application group. The results showed the highest photosynthetic rate, 755 ppm, in the control group; followed by 650 ppm in the foliar group; and 550 ppm in the drench group. The hypothesis was not supported by the data. Results indicate that imidacloprid methods impact photosynthetic rates differently. This is of importance in plant production and pesticide application strategies. Further research is needed to strengthen the validity of these findings.


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 Cricket Meal as an Alternative Fertilizer to Fight World Hunger
Brett Wells

The human population is growing quickly and with that the demand for food is directly proportional. It is possible to increase food production through strong fertilizers. One possible natural fertilizer for this purpose is cricket meal containing many of the nutrients vital to plant growth.

The purpose of this research was to determine whether the application of cricket meal would enhance plant growth in a way that is similar to that of more commonly used fish meal. This was tested by using natural topsoil containing no fertilizer as a control while one experimental group contained topsoil mixed with fish meal and a second experimental group’s soil was mixed with cricket meal.

Statistical analysis via a t-test indicated the null hypothesis, that there would be no difference in the impact of growth on the plants treated with fish meal and with cricket meal, was supported. This indicated that cricket meal may be a comparable alternative to fish meal fertilizers. This is beneficial because cricket farming is a growing industry that can produce a higher level of biomass at cheaper costs than catching fish which are much more beneficial when consumed. Further research would involve testing on a larger scale employing different concentrations of fish meal and cricket meal so that the optimal cost efficiency-to-growth rate could be determined. Testing with various crops is also warranted. Since different parts of the world have greater access to crickets than fish, cricket meal may be an ideal fertilizer for farms in these locations.


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 B-Nine on Photosynthetic Rates

Jacob Ziemann

This experiment tested the effect of the plant growth regulator (PGR) B-Nine on photosynthetic rates of Supertunias. B-nine is commonly used in plant production and research as a PGR that shortens intermodal length making the plant more compact. The label on B-nine specifically states that it does not affect photosynthesis. Photosynthetic rates were tested using a CO2 sensor to measure and compare carbon dioxide usage in five-minute intervals. B-nine was applied at 1:100 (ppm) via a backpack sprayer. Data indicated that plants treated with B-nine on average had more CO2 in the chambers after the five-minute testing period than the control group, supporting the claim. The independent variable was whether or not plants were treated with B-nine. The dependent variable was the amount of CO2 left in the chambers after five minutes. In this experiment B-nine impacted photosynthetic rates. The average rate for the control group was 580 ppm CO2 whereas the average for the experimental group treated with B-nine was 700 ppm CO2. It could be concluded that since there was a negative effect on photosynthetic rates, then there may be a negative effect on the total growth of the plants. This could impact how growers use this PGR and possibly mandate changes to the current label.


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).
### Robotics & Intelligent Machines (2000)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001T12</td>
<td>Basharmal, Adrees</td>
<td>The Effect of Task Complexity on Time to Mastery for Machine Learning Agents</td>
</tr>
<tr>
<td></td>
<td>Nguyen, Andy</td>
<td></td>
</tr>
<tr>
<td>2002X12</td>
<td>Howard, Madeline</td>
<td>Testing the Reaction Time of Machine Learning</td>
</tr>
<tr>
<td>2003X12</td>
<td>Payne, Gregory</td>
<td>Using RandomForest Algorithmic to Predict Cancer Survivability</td>
</tr>
</tbody>
</table>

Category Student Count: 4
The Effect of Task Complexity on Time to Mastery for Machine Learning Agents
Adrees Basharmal, Andy Nguyen

Artificial Intelligence has been a growing impetus for research and also an influence in the workforce in modern society. Particularly, reinforcement learning, a method of machine learning in which the learning agent seeks specific sequences of actions to enhance its rewards, is currently being used to revolutionize the fields of medicine and robotics. Understanding the rates of learning with regards to task complexity and implementations of internal/external support systems is a key step towards optimizing the application of Artificial Intelligence. Data for the reinforcement agent’s learning progressions for each game will ultimately explain how as task complexity increases, the time spent in the blind learning process towards mastery increases; however, the general function remains the same. In other words, an agent will go through a longer period of blind learning if the game has more options for it to take, but for any game it should reach a point where it has “learned” and proceed to excel into mastery. A large sample of tasks, mostly classic arcade games, will be gathered and tested by implementing an OpenAI open-source agent to learn the task with minimal knowledge. Game complexity is determined by the number of different inputs the Artificial intelligence has. The agents data, recorded through an Apple Macbook terminal, is graphed based on the average score, also known as fitness, compared to time being trained. Preliminary testing with drafts of the algorithms for the agent have shown a direct correlation between the task complexity and the processing time it takes for the agent to become proficient at the task; however, data is not yet finalized, but the data appears to be that of an exponential regression.


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 the Reaction Time of Machine Learning
Madeline Howard

Machine learning is becoming an integral part of modern society, ranging from suggesting posts to users on social networking sites to the deep learning mechanics incorporated into the algorithms of self-driving cars. It is important, with this new surge of machine learning, to ensure that the algorithms incorporated into these machines respond to outside stimuli quickly and efficiently. The purpose of this experiment is to test the reaction time of a smaller scale machine learning unit for the ability to navigate mazes. To test the machine's reaction time, two mazes with slight variations in the path were constructed, one with a simpler solution and one with a more complex solution. Through testing, it was discovered that there is a significant difference in the reaction time between the first and second maze, confirming a positive reaction time with a p-value of 0.000122. This means that the machine learning unit could compute and navigate the maze with a successful reaction time, though data is continuing to be gathered.


Using RandomForest Algorithmic to Predict Cancer Survivability

Gregory Payne

Cancer of all types affects millions of people every year, and is a difficult time for families. It is a very complicated subject that is mostly understood by professionals, and that often leaves families with concerns. My goal was to create a program that could predict the survivability of a cancer patient based on previous patient’s experiences. In order to do this, I had to use a database and set up a machine learning program called randomForest, which sorts data into buckets and allows new data to be tested against the database. Once I could put the database into randomForest and randomForest into my own program, I could begin testing reliability and accuracy. To test for reliability, I used patients that were not put into the algorithm and put them through the program. Since I already knew their chance of survival from the database, I could run a confidence statistic test to test reliability. My program was 88% accurate on the first run. To test accuracy, I found a program with a similar use to mine and ran similar patients through each. After getting my results i ran a paired t-test and found that the data had a 93% correlation rating.


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).
## Systems Software (2100)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>2101X12</td>
<td>Adapa, Keerthana</td>
<td>Testing the Accuracy of a Machine Learning Text Classifier</td>
</tr>
<tr>
<td>2102X12</td>
<td>Ahmad, Ibrahim</td>
<td>The Effects of Different Machine Learning Algorithms on the Accuracy of a Diabetes Classifier</td>
</tr>
<tr>
<td>2103T12</td>
<td>Bogucki, Colton Lu, Jessica</td>
<td>EMS Duty Check</td>
</tr>
<tr>
<td>2104X12</td>
<td>Dawson, Samuel</td>
<td>Creating a Computer-aided Method for the Automatic Quantification and Analysis of Animal Behavior</td>
</tr>
<tr>
<td>2105T12</td>
<td>Cosgrove, Raymond Filicetti, Peter</td>
<td>Stock Market Anticipations: Predicting Fluctuations in Stock Market Prices Using Neural Networks and Media Parsing</td>
</tr>
<tr>
<td>2106X12</td>
<td>Hale, Andrew</td>
<td>Analyzing an Olfactory Sense Database Using Python to Facilitate Scent Manufacturing</td>
</tr>
<tr>
<td>2107T11</td>
<td>Jassal, Karanvir Khader, Sajjaad</td>
<td>Predicting Stock Price Trends using Machine Learning and Mathematical Modeling</td>
</tr>
<tr>
<td>2108X12</td>
<td>Kishore, Raj</td>
<td>The Effect of the Type of Regression on the Accuracy of the Predicted House Prices</td>
</tr>
<tr>
<td>2109X12</td>
<td>Kulkarni, Varun</td>
<td>SeeCodeRun: An Online Javascript Environment with Developer-Centered Features</td>
</tr>
<tr>
<td>2110T12</td>
<td>Gilbert, Cassandra Lin, Ze</td>
<td>The Analysis of the Usability and Design of Medical Applications to Reduce the Rate of Accidental Drug Misuse in Older Users</td>
</tr>
<tr>
<td>2111X11</td>
<td>Mishra, Soumya</td>
<td>Using Statistics to Solve the Problem of Sorting Big Data</td>
</tr>
<tr>
<td>2112X12</td>
<td>Peterson, William</td>
<td>Development of a Computer Aided System for the Classification of Breast Lesions from Mammogram Scans</td>
</tr>
<tr>
<td>2113X10</td>
<td>Srigiriraju, Krishna</td>
<td>Attendance-Taking QR Code Scanner Prototype</td>
</tr>
<tr>
<td>2114T12</td>
<td>Burbano, Nicolas Vishnubhatla, Rohit</td>
<td>Optimal Schedule Change Process Automated by a Computer Program</td>
</tr>
<tr>
<td>2115X12</td>
<td>Wolinsky, Rena</td>
<td>The Development of the CIA (Cyber aggression/ Cyberbullying Intelligence Algorithm)</td>
</tr>
</tbody>
</table>

Category Student Count: 20
Testing the Accuracy of a Machine Learning Text Classifier
Keerthana Adapa

Machine learning has become prevalent in modern technology. A supervised machine learning system utilizes training data fed into the system beforehand to virtually model the data with its corresponding labels. Once the system is “trained”, it can be used to answer unknown questions.

This experiment explored the effectiveness of a machine learning algorithm. Specifically, the accuracy of a machine learning classifier will be tested when identifying the topic of blog texts from College Confidential into predefined categories: “School Environment”, “Chance Me”, “Application Tips”. This assessment has not been tested in previous work. Using the Scikit-Learn library for Python, a classification program was created, trained with data and its complementary label/topic, and tested to identify the topic of an unknown blog text. Compared to a linear search classification algorithm, the machine learning program was tested and found to be statistically significant using Chi Square analysis \( p<0.05 \) with a 95% accuracy rate. Much like any other computer programs, this computer program is only symbolization of its versatile use in society. This program expresses the capability of a machine learning program in classifying text in a specific blog.

Given any other texts such as emails, letters, or songs (as training data), it will efficiently identify the topic of the test data. Future research could build on this topic by identifying different aspects of a text such as sentiment and author, or experimenting with a different medium such as images or audios. This research can be used to increase the capability of technology.


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 Different Machine Learning Algorithms on the Accuracy of a Diabetes Classifier

Ibrahim Ahmad

As humanity continues to grow in population, so too will its healthcare needs. High-quality healthcare for all is within reach because of the advancements in technology. With the availability and constant creation of medical data, healthcare is a ripe field for machine learning, the use of algorithms that teach a computer how to do a certain task without purposefully programming it to do so. The purpose of this project is to compare the performance of a few popular machine learning algorithms when applied to medical diagnosis which for this project involves diabetes. A separate classifier was constructed in Python for each of the three machine learning algorithms: Naive Bayes, Random Forest, and Logistic Regression. Each classifier was trained with the Pima Indians Diabetes Dataset. The proportion of training data to testing data was varied using incremental changes of 10%. The accuracy of each machine learning algorithm was calculated and then displayed using the "print" function in Python. Data visualization was done using both Google Sheets and Excel. It can be concluded that there is no significant difference in the accuracy proportion between the three algorithms as the P-Value was greater than the alpha level of 0.05. This suggests that there is consistency between the algorithms and so they all can be used to check one another for anomalies. Data from the different train to test ratios is still being collected.


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).
EMS Duty Check
Colton Bogucki, Jessica Lu

At the local emergency fire and rescue station located in Purcellville, volunteer aides and emergency medical technicians (EMTs) must perform a routine check of the ambulances, dubbed a “duty check,” prior to each 12 hour shift. These duty checks involve counting the number of gauze rolls, splints, blood pressure cuffs, and more throughout the ambulance by hand and although they are tedious and rather time-consuming, they are a necessity in order to ensure that the ambulance on call is properly stocked in times of need. They are performed using a paper-and-pencil checklist making it rather difficult to detect exactly when the ambulance requires restocking. This study works to digitize this checklist by creating a mobile application capable of keeping track of item stock and warning volunteers of low supplies. The app is predominantly made up of two screens with the ‘duty check’ screen containing a list for all of the materials and the ‘restock’ screen containing a list of supplies in need of restocking. Once restocked, the item will be removed from the restock screen and the stock count for the item will reset. In the ‘duty check’ screen, users will press a button for each item used in a shift and the app will subtract one from the item count. By using this application, users would not have to check over the entire ambulance at the beginning of each shift, thus making the duty check process easier as well as more efficient for fire and rescue volunteers.


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 - 2018

Creating a Computer-aided Method for the Automatic Quantification and Analysis of Animal Behavior

Samuel Dawson

Developing an understanding of the relationship between the brain and movement is a fundamental question of neuroscience, whose answer can lead to more advanced neuroprosthetics and cures to neurodegenerative diseases. Mice and other organisms are often used as models for humans. During experiments, neuronal data is collected; however, this data provides only half the picture. To fully understand how the brain is influencing movement, the surrounding environment and the organism's behavior must be analyzed as well. Right now, the primary way to quantify behavior is through manual, human scoring, which is inefficient, inaccurate, and time-consuming. Humans are prone to error, and scores can vary between each observer. Additionally, human-driven analysis tends to only focus on one specific action at a time. Robust data analysis techniques have the potential to revolutionize the field of neuroscience by automating the process of behavior quantification. Histograms of Oriented Gradients (HOG) and Histograms of Optical Flow (HOF) features propose a solution to this problem. The combination of HOG-HOF features presents a way to quantify the entire behavior of an organism, efficiently and without bias. By pairing the data collected from inside and outside the organism, the relationship between neural activity and subsequent movement can be measured, elucidating the specific role of the brain in a variety of actions.


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).
Stock Market Anticipations: Predicting Fluctuations in Stock Market Prices Using Neural Networks and Media Parsing
Raymond Cosgrove, Peter Filicetti

Over the past decade, with the massive influx of social media usage, the amount of public data has increased dramatically. There has also been many major technological advancements, allowing for machine learning - programs that learn and adapt from data - to become more relevant. The purpose of this experiment is to determine if this public data can be used in order to augment the accuracy of stock price prediction. It is hypothesized that the use of quantitative stock data combined with the sentiments of publicly available opinions on Twitter will be more accurate in the prediction of stock prices compared to the sole use of quantitative data. In this experiment, tweets directed toward or mentioning AMD were collected using Twitter’s advanced search function. The Python programming language was used to collect historical stock data of the company AMD as well as to analyze the sentiment of collected tweets. Then, two artificial neural networks were constructed, one that predicts based off of stock data and one that predicts based off of stock data and the "Twittersphere" sentiment regarding AMD. These networks will be trained using 70% of the collected data and later tested using the remaining 30%. The accuracy of the two networks will then be analyzed, determining the effectiveness of the sentiment analysis. This research is important because it could allow for vast improvements in economic fields and provide financial gain for many people. In the future, more research could be done on this topic by using different types of social media, such as Instagram and Facebook. Additionally, different stocks could be tested to see which are able to be most accurately predicted, whether that be due to heightened social media presence on the part of the company or, perhaps, differing volatility of the given company’s stock prices. Data is still being collected.


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).
Analyzing an Olfactory Sense Database Using Python to Facilitate Scent Manufacturing
Andrew Hale

Scent is one of the most powerful senses that the human body possesses and over the years humans have been able to harness that sense to provide experiences, medical care, and enjoyment to the masses. Scent has been harnessed to help ease chronic pain and even pain during labor. Many hospitals and doctor's offices even use hits of lavender and vanilla to help patients relax during their visits. The power of scent is enormous and if it can be tailored and fine-tuned at a faster rate there could be even more innovations just over the horizon. However, dealing with scent is a tricky subject and is a very limited field. With only around 500 flavorists located in the United States the job market for scent and flavor creation has room to grow.

Flavorists go about creating scents and flavors mostly through trial and error, unless they have prior knowledge about a specific chemical combination. What would help facilitate growth in this industry would be an alternative to the usual trial and error that comes with the job. Creating a computer program that guides flavorists towards their desired scent would greatly increase the speed and quality of scent and flavor production.

This program would have to have the ability to sort through mass amounts of data and pull out what the user is looking for within a timely manner. The user would be able to select through many descriptors and tailor their desired scent to their liking. Users will then be presented with the necessary information for them to recreate the scent that they have selected such as dilution levels, intensity, and the chemical formula itself.


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).
Predicting Stock Price Trends using Machine Learning and Mathematical Modeling

Karanvir Jassal, Sajjaad Khader

Since the inception of the financial stock market, investors have been trying to figure out how to find and buy a good stock at the best price to optimize their ROI (return on investment). The problem of this project is unearthed: how to aid investors in their security investment strategies. To serve investors in the best manner, multiple stock price prediction models were created. A Naive Bayes, Neural Network, and Linear Regression Time Series models were built to determine the price trend of a given stock. All three models were built using RapidMiner data mining software and the first two aforementioned models were also scripted and executed using R programming language for comparison purposes. Data was collected from the S&P 500 stock market index, processed, then two data sets were created - one for training and the other for testing the models. The performance percentages of the confusion matrices clearly reveal that the Neural Network model, which yielded results of 90.07% accuracy, is superior to the Linear Regression and Naive Bayes models, which yielded results of 86.13% and 79.30% accuracy, respectively. However, none of these models should be overlooked as they each are better options than investors’ current source of decision-making, which is incomplete information (tips, emotions, skewed reports). Also, to further improve investors’ decision-making and enhance this project, other attributes, such as other economic and financial data, as well as experimenting with the data ratio for training and testing purposes, can improve the performance percentages of the models.


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 Regression on the Accuracy of the Predicted House Prices

Raj Kishore

People are always moving and looking for their ideal house. One major issue is dealing with the price of the house. The objective of this project is to determine which regression will be better, linear or non-linear (independent variable), to predict the price of a house (dependent variable) based off features such as square footage, age, the type of house, and others. The regression algorithm determines an optimal model that best fits the training data by finding the best parameters that minimize the difference between the actual values and predicted values from the model. The models were trained with 376 house data points and were tested with 97 house data points. The dataset contains residential home sales information from the city of South Riding, Virginia during 2017. The root mean square error (RMSE) was 44493.12 for the linear model, and 40579.46 for the non-linear model. Since the non-linear model had the lower RMSE, it was supported to be the most accurate model. Also, since the comparison is between the predicted values and the actual values, a high p-value is preferred, so that it shows a better prediction. Compared to the p-value of 0.2668 for the linear model, the non-linear model had a p-value of 0.3514 and was supported to be the better regression for predicting house prices. Further research would include using more data and features, and expanding to cities other than just South Riding.


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).
SeeCodeRun: An Online Javascript Environment with Developer-Centered Features
Varun Kulkarni

Javascript is a web development language that enables programmers to make websites more interactive and immersing. Though web developers extensively use Javascript with the static languages of HTML and CSS, fixing errors in code is difficult when the code doesn’t properly function. For this reason, developers turn to StackOverflow, a forum of questions and answers on almost any programming language. George Mason University studied over 300 Javascript-related questions on this database and created SeeCodeRun, an online environment that aims to accomplish three goals: allow developers to visualize their website, help developers fix errors more intuitively, and give developers more insight on how their code works.

The goal of this research period’s implementations was to remedy potential confusion to the developer when functions such as “append” and “each” change different visual elements on a given website than anticipated. Such selector functions will change the elements manipulated in further lines of code, so when developers progress through their design process and realize that the wrong elements are being changed, they may want to have a direct link between such functions and the output generated. SeeCodeRun will help this problem by allowing developers to hover over a given line and see the output portion that is affected. It also provides a reverse link, so when a visual element which has been modified by Javascript is hovered over, the element will color and allow developers to see what lines of code have acted on that object.


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 Analysis of the Usability and Design of Medical Applications to Reduce the Rate of Accidental Drug Misuse in Older Users

Cassandra Gilbert, Ze Lin

Accidental drug misuse is a leading cause of death in the United States, and this fatal issue has the largest impact on the older members of the population. Due to factors that range from the body’s declining rate of drug elimination as it ages to the likelihood of older individuals to take more medication regularly, this demographic suffers greatly from the lack of access to information that would prevent injury of this sort. Although applications that provide this information do exist, developers tend not to take the needs of older users into consideration throughout the creation of these resources. This project aims to find trends in the deficiencies of popular medical applications in relation to the ease of use of the target demographic. The top medical apps on the Google Play Store were reviewed in order to judge whether their designs were ergonomically beneficial to the elderly. This analysis was based on an operationally defined rendition of Phiriyapokanon’s guidelines. Data collection for this project is pending. This manner of research plays a fundamental role in raising awareness of the specific features of medical applications that benefit the users with the highest need for those applications, and ultimately has the potential to incite changes in app development that will meet the needs of these users.


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 Statistics to Solve the Problem of Sorting Big Data
Soumya Mishra

Sorting algorithms are widely used in computer programming but have two key features that present challenges: highly iterative processes requiring intense data churning and large memory requirements to execute these processes. Furthermore, the advent of Big Data has created a greater urgency for better sorting algorithms. Given the nature of sorting, it is self-evident that sorting 1TB of data would be much harder than sorting a thousand ordered set of 1GB data each. The objective of this research was to create an algorithm to distribute the data into ordered sets, of the same frequency by using statistical means. The framework of this algorithm consisted of four major steps: collect statistical information of the data (mean, standard deviation, distribution type, minimum, maximum), assign each element in the data set to one of the ordered buckets, sort each bucket, and then concatenate the buckets into a sorted list. The crux of this algorithm is assigning each element to a bucket. Three options were evaluated for the same. The first option involved using mean and standard deviation to determine bucket number and was approximately 60% more efficient than using current sorting algorithms. The second option involved integrating the function of the distribution curve - that fit the data set - from the minimum value to the value being assigned to a bucket. The third approach involved splitting up the data set into quantiles and then sorting them as if they were the buckets themselves. Research on the second and third techniques 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).
Development of a Computer Aided System for the Classification of Breast Lesions from Mammogram Scans

William Peterson

Over the past few decades, Computer Aided Diagnosis systems have grown in popularity to improve mammogram performance. Currently, these systems do not suggest diagnosis; rather, most only highlight suspicious lesions. This project aims to take performance a step further, using a convolutional neural network trained on images from USF’s Digital Database for Screening Mammography to classify lesions. First, a support vector machine (SVM) was created and optimized using a genetic algorithm with data gathered from UCI’s Mammography Database. The SVM received a positive accuracy of 89.7% and a negative accuracy of 68.1%. Radiologists’ assessments gathered from the UCI database were used to measure performance and received a positive and negative accuracy of 97.0% and 6.4%, respectively. Next, a convolutional neural network (CNN) system was created and modelled after the same architecture used to classify handwritten digits. For preprocessing, each image was rotated 90°, 180°, and 270° and resized to 28x28. Array of images were then shuffled randomly and passed through the CNN for training. Due to the random order of the input for the CNN, positive and negative accuracies varied but were optimized at values of 92.5% and 87.9%, appropriately. The weights from the CNN were then saved and used to allow the system to work inside of an application, allowing radiologists to save patient info, upload images, and highlight lesions for the trained convolutional neural network to classify. This research will hopefully support the application of machine learning in future practices.

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).
Attendance-Taking QR Code Scanner Prototype
Krishna Srigiriraju

The goal of this research project is to design and prototype a functioning QR code scanner with a Raspberry Pi, which will be used to take class attendance efficiently. All teachers and professors have hectic schedules and sometimes struggle to stay on top of their tasks. With so much going on, many either detest taking attendance or forget to take class attendance altogether. If each student took his/her own attendance, it would eliminate the need for the teacher mark present and absent students, therefore eliminating even the possibility of the teacher or professor forgetting to take attendance. It is hypothesized that with a QR code for every student and a QR code scanner in every classroom, students will be able to quickly mark themselves present upon entering their classroom or lecture hall. The QR code scanner was built using a Raspberry Pi (Model B) and a Camera Module v2, also made by Raspberry Pi. Thus far, the prototype has been able to successfully read the QR codes and store the transmitted information in a separate text file. The next step in this research project would be to enable the Raspberry Pi to add and remove students to and from a specific class list and to decrease the amount of time needed for the Pi to scan and store the information in QR code being scanned.


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).
At the beginning of this school year, we were both found in a situation where we felt it was necessary to switch out of a class that we were enrolled in. But, to our surprise, the schedule change process was largely manual and very inaccurate. In fact, most of the ideas had to come from the student requesting the change. So, we seized this opportunity to create a product which not only would deliver a schedule that might not have been proposed before, but would also save the time and effort of both counselors and students. We formulated a back-end structure composed of a SQL Relational Database run on PostgreSQL, and a Java program which houses the scheduling algorithm, and this would all be packaged into a simple, and easy to use Graphical User Interface. The database would be composed of five tables which all have relational components which can be accessed, analyzed and edited by the Java algorithm. The program is able to quickly calculate the best solution for the schedule change and present the user with an updated schedule, while concurrently updating class records to ensure an updated record of class sizes and availability numbers.
The Development of the CIA (Cyber aggression/ Cyberbullying Intelligence Algorithm)

Rena Wolinsky

Advancement of the internet and society's increased reliance on the former has created many communication advancements. One insidious consequence of increased technology access, however, is cyber aggression and cyberbullying. Cyber aggression is aggressive online behavior that uses the internet to psychologically hurt others. Cyberbullying is a type of cyber aggression where one user is "inferior" and repetition of hostility extends over time.

Previously developed algorithms analyze language patterns used by bullies and victims to detect cyberbullying content. Most of this dealt with cyber aggression rather than cyberbullying by not taking into account power imbalance and repetition of abuse. The cyber aggression/ bullying intelligence algorithm (CIA) employed here was created using jGRASP IDE and Java code. The goal was to analyze various aspects of internet comments, including curse words, second and third person pronouns, repeated abuse, and power imbalance. The number of curse words indicated how angry or hostile the user was when creating a post, and pronouns suggested anger from the curse words noted previously was aimed at another person. The CIA differs from previous research since its outcomes are cyber aggression and cyberbullying coefficients that indicate their respective harshness as the coefficients value increases while other algorithms solely tag posts as cyberbullying and remove them from the internet.

Decisions regarding whether freedom of speech is more important than stopping cyber aggression and cyber-bullying need to be made. Social media organizations can use coefficients created here to determine their involvement in controlling cyber aggression and cyber-bullying.


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).
### Translational Medical Science (2200)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Last, First Name</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>2201X12</td>
<td>Chandra, Sonia</td>
<td>An Investigation of the Potential of Combinations of Rosmarinic Acid and Thymol for Treatment of Lung Cancer</td>
</tr>
<tr>
<td>2202X12</td>
<td>Glidden, Meghan</td>
<td>Eliminating Stroke Induced Deficits via Early Administration of Narcan</td>
</tr>
<tr>
<td>2203X12</td>
<td>Goel, Himanish</td>
<td>The Effect of Tulsi (Ocimum sanctum) on the Lifespan of Fruit Flies</td>
</tr>
<tr>
<td>2204T12</td>
<td>Herz, Sara Safeer, Huzaifa</td>
<td>BACE1’s Impact on the Agility and Mental Processing of Ants</td>
</tr>
<tr>
<td>2205T12</td>
<td>Kuruba, Ramya Reddy, Rachna</td>
<td>Effects of Intrauterine Hypoxia on Physiological Brain Development in Zebrafish Embryos</td>
</tr>
<tr>
<td>2206T11</td>
<td>Nazzaro, Thomas Pondugula, Soumya</td>
<td>Determining the Effects of Lactobacillus on the Mobility of a C. elegans Model of Parkinson’s Disease</td>
</tr>
<tr>
<td>2207X12</td>
<td>Taylor, Michael</td>
<td>Bdellovibrio Bacteriovorus as Alternative to Common Antibiotics</td>
</tr>
</tbody>
</table>

Category Student Count: 10
**LCPS RSEF OFFICIAL ABSTRACT - 2018**

An Investigation of the Potential of Combinations of Rosmarinic Acid and Thymol for Treatment of Lung Cancer  
Sonia Chandra

Cancer is one of the leading causes of death in the United States. Modern treatments, such as chemotherapy and radiation, kill cancer cells but also affect healthy cells. Less damaging antitumor medications have been sought, often from plant sources. This experiment is designed to assess combinations of two plant derivatives, thymol and rosmarinic acid. To determine if the derivatives are only cytotoxic towards cancerous cells, two cell lines are used: cancerous A549s and noncancerous MRC5s. They are both human lung cell lines. Each cell line will be treated with either thymol, rosmarinic acid, or a combination of the two. Controls include media and ethanol (EtOH) treatments, as well as *Thymus serpyllum* (wild thyme) oil. After treatment, the amount of viable cells is assessed using either a colorimetric phosphatase assay or an ATP luminescence assay with a plate reader. Each assay reacts to compounds that are produced by healthy cells and makes compounds that can then be quantified by means of the plate reader. Data collection is ongoing; preliminary results are promising. This research may one day be used to find cancer treatments that have far fewer side effects than current therapies.


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).
## Eliminating Stroke Induced Deficits via Early Administration of Narcan

Meghan Glidden

Strokes and overdoses are two common incidents emergency medical providers encounter on a daily basis. People uneducated on the two may anticipate these are very different problems, but they contain many of the same symptoms. Often times a stroke may be mistaken for an overdose while the medical provider is in the field, and the patient may be injected with Narcan. A person experiencing an overdose due to an opioid will have slowed or no breathing and it becomes hard to wake the patient from this state. Naloxone (Narcan) is a medicine that blocks the effect of opioids, increasing breathing and heart rate, allowing the victim to regain consciousness. In cases of a stroke, naloxone could potentially inhibit neutrophil superoxide which leads to oxygen deprivation. Drosophila were oxygen deprived over a period of time, lowering activity level and mimicking a side effect associated with a stroke. Naloxone (Narcan) was injected when the oxygen level reached 0.25 and after 10 to 20 minutes oxygen was reintroduced to the drosophila to determine if the injection of Naloxone (Narcan) is harmful or beneficial to stroke victims. By studying the effect of Narcan on strokes in Drosophila, it may be able to pin point a possible immediate treatment to delay the deficits caused by a stroke.


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 Tulsi (Ocimum sanctum) on the Lifespan of Fruit Flies
Himanish Goel

Tulsi is a plant known for its antioxidant properties. It is renowned in India for maintaining health of metabolic stress. Tulsi is purported to normalize blood glucose, blood pressure and lipid levels, as well as psychological stress due to its positive effects on memory and cognitive function through its anxiolytic and anti-depressant properties. This experiment investigated the impact of the antioxidant properties of tulsi on lifespan of fruit flies. Tulsi granules were fed to fruit flies in the experimental group for 40 days. Yeast and fruit fly food were fed to the control group. The independent variable was the different percentages of tulsi. The dependent variable was the wild type fruit flies. Lifespan of the experimental group was double the control. Data collected from three trials confirmed these results using Drp 1 which monitors their growth changes. The claim/hypothesis was supported by the data. Tulsi appears to help with metabolic processes and the reproductive system by increasing the energy of the mitochondria in fruit flies. Further research could strengthen the argument that tulsi can have a positive impact on human health due to its ability to increase energy in mitochondria thus improving metabolic processes.

Bhatt, P. (2013). Bioefficacy of botanicals and insecticides against polyphagous insects and phagostimulant activity of medicinal plants to Bombyx mori Linn (Doctoral dissertation, GB Pant University of Agriculture and Technology, Pantnagar-263145 (Uttarakhand)).


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 - 2018

BACE1's Impact on the Agility and Mental Processing of Ants

Sara Herz, Huzaifa Safeer

A chemical in the brain of Alzheimer's patients is known as the beta-secretase (BACE1), or plaque, and causes the deterioration of the brain. Previous studies have shown that the plaque causes brain deficiencies that are irreversible. Our experiment is using groups of ants and inducing their food with the BACE1 enzyme to view the effects on their activities. Studies point in the direction of BACE1 effecting ant ability to follow their chemical trail. The ants that were fed a solution of glucose and water created four ‘Y’ shaped tunnels that were thicker allowing for easier transportation, and the tunnels lengths doubled by day ten. The ants that consumed the enzyme created one narrow 'T' shaped tunnel and all the ants slowly moved at the surface and by day ten created five 'T' shaped tunnels. A second study examined the mobility of ants, and after conducting a circle displacement test the ants with no impairment ran three circles and 10cm in 11.9 seconds; ants with BACE1 ran three to four circles and 10cm in 39.41 seconds. (More data is being gathered to test group 3 and 4.) After ten days, the harvester ants that were fed the plaque could not withstand the enzyme and died. Giving the ants impairment during earlier stages alter the progression and show that the deterioration of the patients' cognitive abilities is at its prime during the beginning stages of Alzheimer's.


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 Intrauterine Hypoxia on Physiological Brain Development in Zebrafish Embryos
Ramya Kuruba, Rachna Reddy

A majority of fetal development depends on maternal conditions. During pregnancies, periods of exposure to hypoxic states have developmental implications to the fetus. Hypoxia is the depletion of the levels of oxygen that reaches the tissue. Often times, short spans of hypoxic levels in mothers go unnoticed and the consequences to the fetus are unknown. In this experimental apparatus the developmental cognitive repercussions of fetal exposure to hypoxic conditions will be observed using a zebrafish (Danio rerio) model. We will be assessing this by stimulating the hypoxic event at different time intervals and using a Western Blot to look at the developed proteins. By doing this experiment, it can be determined if this brief exposure causes damage to the developing brain of the embryos.


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 Effects of Lactobacillus on the Mobility of a C. elegans Model of Parkinson’s Disease

Thomas Nazzaro, Soumya Pondugula

Parkinson’s disease (PD) is a neurodegenerative disorder diagnosed in 60,000 U.S. adults annually. PD is caused by dopamine deficiency in the brain, and one of its most debilitating symptoms is mobility loss. The nematode Caenorhabditis elegans models PD by losing mobility once its dopaminergic neurons are destroyed with oxidopamine (6-OHDA). Bacteria of the genus Lactobacillus are commonly used probiotics. Lactobacillus increases mobility in wild-type C. elegans after colonizing their gut microbiome upon consumption. The purpose of this project is to determine if a dietary pretreatment using Lactobacillus compensates for the loss of mobility from neuron damage in PD model C. elegans. Four groups of C. elegans were raised on four different Lactobacillus species before being given 6-OHDA. Mobility was assessed via locomotion and thrashing assay values for each group. These values were compared to control groups given the respective Lactobacillus treatment, but not treated with 6-OHDA, as well as C. elegans raised on E. coli with and without 6-OHDA treatment. A Kruskal-Wallis test showed that the L. casei experimental group and the control groups had a statistically significant difference (p-value less than 0.05) in their thrashing and locomotion rates. The PD model nematodes raised on L. casei had double the locomotion and thrashing values of the PD model nematodes raised on E. coli, but still exhibited less mobility than the two control groups that did not model PD. Data collection for the other Lactobacillus species is ongoing. These results suggest that Lactobacillus probiotics may improve mobility in PD 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).
Antimicrobial resistance is becoming a big problem in our modern society. More and more of our commonly used antibiotics are becoming useless against antibiotic resistant bacteria, Methicillin-resistant Staphylococcus aureus being one of the most famous. These bacteria are a big concern, as we are losing our fight with these drug resistant strains. *Bdellovibrio Bacteriovorus* is bacteria that has predatory characteristics against certain bacteria, and could be used as an alternative to common antibiotics. On which bacteria will *Bdellovibrio bacteriovorus* be the most effective (*Staphylococcus, Escherichia, Sarcina*)? Why will *Bdellovibrio bacteriovorus* work on some bacteria but either not work or be less effective on others? Perform a zone of inhibition test with the *Bdellovibrio bacteriovorus* on the various tested bacteria. In dishes where *Bdellovibrio bacteriovorus* had been added, there showed significantly poorer growth of *Staphylococcus* and *Escherichia* when compared to their respective control group. The *Bdellovibrio bacteriovorus* showed to greatly retard the growth of these bacteria from the start. These results show a trend of *Bdellovibrio bacteriovorus* having a negative effect on the development of the majority of these harmful bacteria. This is significant in that *Bdellovibrio bacteriovorus* could be used as an alternative to standard antibiotics that are commonly used today. This would decrease the severity of any super resistant bugs that develop in our near 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).