Summer Undergraduate Research at Trinity

Although summer undergraduate research has been going on at Trinity since the 1950s, the first Undergraduate Research Symposium was sponsored by Trinity’s Chemistry department in 1984 and involved 10 participants. From that beginning, Trinity’s Summer Undergraduate Research Program has grown to involve more than 150 students and 70 faculty members in 2016.

The Welch Foundation has supported student and faculty researchers in chemistry since 1997. In addition, grants from the Merck Foundation (2001-2009) and the W. M. Keck Foundation (2003) supported research collaborations between biologists and chemists.

Grants in 2004 and 2008 from the Howard Hughes Medical Institute provided summer research fellowships for students in addition to transforming Trinity’s curricular offerings in the sciences and enhancing outreach to local schools.

The National Science Foundation (NSF) supported Research Experiences for Undergraduate (REU) Programs at Trinity in chemistry (1989-2000), mathematics (1997-2008) and computer science (2008-2010). In addition to individual faculty research grants, NSF currently supports Trinity programs for scholarships for STEM majors (FAST and FASTER Programs) and students interested in biomathematics (Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences program). In addition, the Beckman Foundation supports undergraduate research in Biology, Chemistry, and Neuroscience.

In recent years, undergraduate research in non-STEM fields have developed and grown. In 2008, Trinity started a Ronald E. McNair Post-Baccalaureate Achievement Program with funding from the U.S. Department of Education. In 2011, Trinity launched the Murchison Fellowships program, which funds summer projects proposed by faculty-student teams. The University also supports research opportunities through operating funds. In 2013, Trinity received support from the Andrew W. Mellon Foundation to support undergraduate research in the arts and humanities. Summer research experiences are also supported in Urban Studies thanks to a grant from the San Antonio Housing Authority. Entrepreneurship students are also engaged in scholarly experiential learning due to grant funding from the Stumberg Foundation and the 80/20 Foundation.

This year’s conference will include more than 150 posters and oral presentations as well as presentations from undergraduates at other institutions in San Antonio.

I hope that you enjoy the 2016 Trinity University Undergraduate Research Conference.

-Jacob K. Tingle, Ed.D., Director of Experiential Learning
Conference Schedule At-A-Glance

Tuesday, July 26, 2016
3:00 – 5:30 p.m.
Poster Session
Location: Center for Sciences & Innovation Atrium & Design Cube

Wednesday, July 27, 2016
8:15 – 10:00  Multidisciplinary Session A  CSI 330
8:15 – 10:00  Multidisciplinary Session B  CSI 102
8:30 – 10:25  Chemistry Symposium Session A  CSI 437
10:15 – 12:00 Multidisciplinary Session C  CSI 330
10:15 – 12:00 Multidisciplinary Session D  CSI 102
10:35 – 12:10 Chemistry Symposium Session B  CSI 437
11:45 – 1:15 Lunch (for presenters & mentors)  CSI Atrium
1:15 – 3:00  Multidisciplinary Session E  CSI 102
1:15 – 3:00  Multidisciplinary Session F  CSI 330
1:30 – 3:25  Chemistry Symposium Session C  CSI 437
3:15 – 4:45  Multidisciplinary Session G  CSI 102
3:40 – 5:00  Chemistry Symposium Session D  CSI 437
3:40 – 5:00  Chem, Bio, & Nuero Symposium Session E  CSI 256
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<td>Alana &amp; Acevedo</td>
<td>Prostaglandin Expression as a Protective Marker of Gastrointestinal Injury in a Non-Human Primate Explant Model</td>
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### Multidisciplinary Session A • Wednesday, 8:15-10:00 AM  
Moderator: Dr. Heather Sullivan  
CSI 330

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<td>Brown Lives Matter? San Antonio Policing in a National Context</td>
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<td>Baughman</td>
<td>The Varying Understandings of the Hijab in the 2016 Election</td>
<td>Kaufman, Christ, &amp; Noor</td>
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<td>How San Antonians Use the Black Experience to Understand the Anti-Muslim Sentiment during the Presidential Election</td>
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<td>Cinelatinidades: Gender, Sexuality and Cinema in the Americas</td>
<td>Blanco-Cano, Urquijo-Ruiz, &amp; Abreu-Torres</td>
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### Multidisciplinary Session B • Wednesday, 8:15-10:00 AM  
Moderator: Dr. Anne Graf  
CSI 102

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<td>Visualizing the Unspeakable: Graphic Novels and Illustrating the Holocaust</td>
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<td>Second Generation Holocaust Narratives and the Intergenerational Transmission of Memory and Trauma</td>
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**Multidisciplinary Session C ● Wednesday, 10:15 – 12:00 PM**
*Moderator: Dr. Aaron Delwiche*
*CSI 330*

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<td>A Tradition of Change: Text and Paratext in Urry’s Chaucer</td>
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<td>95</td>
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<td>Wilson, E. &amp; Sha</td>
<td>Empowering the Passive: Implications of Increasing NGOs and their Impact on North Korean Refugee Resettlement in South Korea</td>
<td>Yoo</td>
</tr>
<tr>
<td>96</td>
<td>11:45</td>
<td>Conrad</td>
<td>The Compatibility of Artworks and Games</td>
<td>Kania</td>
</tr>
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**Multidisciplinary Session D ● Wednesday, 10:15 – 12:00 PM**
*Moderator: Dr. Dennis Ugolini*
*CSI 102*

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<tbody>
<tr>
<td>97</td>
<td>10:15</td>
<td>Farrell</td>
<td>LIGO Interferometer for Undergraduate Physics Lab</td>
<td>Ugolini</td>
</tr>
<tr>
<td>98</td>
<td>10:30</td>
<td>Jenkins</td>
<td>Using an Electrostatic Force Microscope to Detect Surface Potential</td>
<td>Ugolini</td>
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### Multidisciplinary Session E ● Wednesday, 1:15 – 3:00 PM

**Moderator: Dr. Matthew Hibbs**

**CSI 102**

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<tbody>
<tr>
<td>102</td>
<td>1:15</td>
<td>Cofer</td>
<td>Using Deep Learning to Classify Mutations</td>
<td>Hibbs</td>
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<tr>
<td>103</td>
<td>1:30</td>
<td>Zimdars</td>
<td>Graphing Large Hierarchical Structures</td>
<td>Hibbs</td>
</tr>
<tr>
<td>104</td>
<td>1:45</td>
<td>Lin</td>
<td>Social Network Tolerance Research through Multi-Agent Systems Simulation</td>
<td>Zhang</td>
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<tr>
<td>105</td>
<td>2:00</td>
<td>Studebaker</td>
<td>The Physics of the Relativistic Jet in Quasar 3C207</td>
<td>Hough</td>
</tr>
<tr>
<td>106</td>
<td>2:15</td>
<td>Stein</td>
<td>A Language for Visualizing Dynamical Systems</td>
<td>Fogarty</td>
</tr>
<tr>
<td>107</td>
<td>2:30</td>
<td>Ramnarace</td>
<td>Surface Plasmon Enhanced FRET: Varying the Acceptor Concentration</td>
<td>Steele</td>
</tr>
<tr>
<td>108</td>
<td>2:45</td>
<td>Kurima-Blough</td>
<td>Gamification of the Linux command line</td>
<td>Hibbs</td>
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### Multidisciplinary Session F ● Wednesday, 1:15 – 3:00 PM

**Moderator: Dr. Andrew Kraebel**

**CSI 330**

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<tr>
<td>109</td>
<td>1:15</td>
<td>Farner</td>
<td>Surface Plasmon Enhanced FRET: Varying the Donor Concentration</td>
<td>Steele</td>
</tr>
<tr>
<td>110</td>
<td>1:30</td>
<td>Thomason, Kannen, &amp; Tian</td>
<td>The ZO-1-ZU5 domain and its Function</td>
<td>King</td>
</tr>
<tr>
<td>111</td>
<td>1:45</td>
<td>Lenihan &amp; Roybal</td>
<td>A comparison of germination rates with four vernalization treatments in six Asclepias species</td>
<td>Lyons</td>
</tr>
</tbody>
</table>
Annexins Contribute to Resistance to Ultraviolet Radiation Stress in Leaves but not Roots in Arabidopsis

Developing China’s Wonderland: A Comparison of the First National Parks in China and the United States

The Use of Wharton’s Jelly Derived Mesenchymal Stem Cells in the Field of Neonatology

How Environment Shapes Blood Physiology in Caribbean Anoles

Multidisciplinary Session G ● Wednesday, 3:15 – 4:45 PM
Moderator: Dr. Ruben Dupertuis
CSI 102

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<tbody>
<tr>
<td>116</td>
<td>3:15</td>
<td>Villalpando</td>
<td>The Space Age and Cosmic Connection of Dr. Funkenstein and Sun Ra: Musical Afro-Futuristic Counterculture of the 1950’s-1980’s</td>
<td>Dyer</td>
</tr>
<tr>
<td>117</td>
<td>3:30</td>
<td>Bridges</td>
<td>Reduction of Escherichia coli Populations by Probiotic Bacilli in Limiting Nutrient Environments</td>
<td>Healy</td>
</tr>
<tr>
<td>118</td>
<td>3:45</td>
<td>Sosby</td>
<td>True Community Organizing</td>
<td>Blanco-Cano</td>
</tr>
<tr>
<td>119</td>
<td>4:00</td>
<td>Ramos</td>
<td>Examining the relationship between acculturation and assertiveness on Our Lady of the Lake University’s Helping Profession Majors</td>
<td>Gil</td>
</tr>
<tr>
<td>120</td>
<td>4:15</td>
<td>Ford</td>
<td>Assessing Brain Activity Associated with Emotional Reactivity and Musical Valence and Intensity</td>
<td>Graham</td>
</tr>
<tr>
<td>121</td>
<td>4:30</td>
<td>Pu</td>
<td>Preliminary Characterization of Secondary Metabolites from the WS5995-Producer Streptomyces acidiscabies 84.104</td>
<td>Healy</td>
</tr>
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<tr>
<td>122</td>
<td>8:30</td>
<td>Pollock &amp; Peterson</td>
<td>Studying the Catalytic Behavior and Chemical Properties of Gold Nanoparticles</td>
<td>Pursell, C.</td>
</tr>
<tr>
<td>123</td>
<td>8:50</td>
<td>Palmer &amp; Sarma</td>
<td>Synthesis and Evaluation of Reactive Oxygen Species (ROS)-Activatable Prodrugs</td>
<td>Cooley</td>
</tr>
<tr>
<td>124</td>
<td>9:10</td>
<td>Tallant</td>
<td>Exploring Wider ExBox4+ Analogs</td>
<td>Bachrach</td>
</tr>
<tr>
<td>125</td>
<td>9:25</td>
<td>Karla</td>
<td>Cucurbituril-Induced Peptide Folding</td>
<td>Urbach</td>
</tr>
<tr>
<td>126</td>
<td>9:40</td>
<td>Dwarica</td>
<td>Metal Nanoparticle Synthesis &amp; Characterization</td>
<td>Chandler</td>
</tr>
<tr>
<td>127</td>
<td>9:55</td>
<td>Schreib</td>
<td>Dib1 and its Role in Spliceosome Assembly</td>
<td>Maeder</td>
</tr>
<tr>
<td>128</td>
<td>10:10</td>
<td>Devlin</td>
<td>Investigating the role of deprotonated ligating histidines in H+ translocation at the CuA site of cytochrome c oxidase</td>
<td>Hunsicker-Wang</td>
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**Chemistry Session B ● Wednesday, 10:35 – 12:10 PM**

**Moderator: Dr. Laura Hunsicker-Wang**

**Center for Sciences & Innovation 437 (Treehouse)**

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<tr>
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<tbody>
<tr>
<td>129</td>
<td>10:35</td>
<td>Nguyen, Ta.</td>
<td>Characterization of Natural and Heated Ambers by NMR Spectroscopy</td>
<td>Lambert</td>
</tr>
<tr>
<td>130</td>
<td>10:50</td>
<td>Boms</td>
<td>Synthetic Receptors and Peptide Flexibility</td>
<td>Urbach</td>
</tr>
<tr>
<td>131</td>
<td>11:05</td>
<td>Whittaker</td>
<td>Kinetic Studies of H2 Oxidation to Understand the Role of Water in PROx</td>
<td>Chandler</td>
</tr>
<tr>
<td>132</td>
<td>11:20</td>
<td>Cho</td>
<td>Searching for a Möbius Strip with Cyclometaphenylenne</td>
<td>Bachrach</td>
</tr>
<tr>
<td>133</td>
<td>11:35</td>
<td>Tahseen</td>
<td>Exploring the Importance of the C-terminal tail of a Small Essential Protein Dib1 in Pre-messenger RNA Splicing</td>
<td>Maeder</td>
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</tbody>
</table>
### Chemistry Session C ● Thursday, 1:30 – 3:25 PM
**Moderator: Dr. Christina Cooley**  
**Center for Sciences & Innovation 437 (Treehouse)**

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<tbody>
<tr>
<td>135</td>
<td>1:30</td>
<td>Shepherd</td>
<td>Changes in Reduction Potential of the [2Fe-2S] Cluster of the Rieske Protein Using Multiple Non-Covalent Interactions</td>
<td>Hunsicker-Wang</td>
</tr>
<tr>
<td>136</td>
<td>1:50</td>
<td>Zayat</td>
<td>Nitrogen-Substituted Dienes in the Diels-Alder Reaction</td>
<td>Bachrach</td>
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<tr>
<td>137</td>
<td>2:05</td>
<td>Babcock</td>
<td>Effects of Neighboring Sequence Context on Cucurbituril-Peptide Interactions</td>
<td>Urbach</td>
</tr>
<tr>
<td>138</td>
<td>2:20</td>
<td>Nguyen, Tr.</td>
<td>Steric Effects on the Configuration of the Nitrogen in Piperidine</td>
<td>Lambert</td>
</tr>
<tr>
<td>139</td>
<td>2:35</td>
<td>Morrison</td>
<td>Expanded ExBox4+ Analogue Binding Multiple Guest</td>
<td>Bachrach</td>
</tr>
<tr>
<td>140</td>
<td>2:55</td>
<td>Hirani</td>
<td>Exploring Sequence Effects in Cucurbituril-Peptide Interactions</td>
<td>Urbach</td>
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<tr>
<td>141</td>
<td>3:10</td>
<td>Santos &amp; Tombo</td>
<td>The Role of Water in the Selective Oxidation of Benzyl Alcohol Over Gold Nanoparticle Supported Catalysts</td>
<td>Chandler</td>
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</table>

### Chemistry Session D ● Wednesday, 3:40 – 5:00 PM
**Moderator: Dr. Chris Pursell**  
**Center for Sciences & Innovation 437 (Treehouse)**

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<tr>
<td>142</td>
<td>3:40</td>
<td>Koeller</td>
<td>High Affinity, Reversible Complexes</td>
<td>Urbach</td>
</tr>
<tr>
<td>143</td>
<td>4:00</td>
<td>Huther, Elizondo, &amp; Krause</td>
<td>Support effects on Hydrogenation of Metal Oxide Supported Catalysts</td>
<td>Chandler</td>
</tr>
<tr>
<td>144</td>
<td>4:15</td>
<td>Huther, Elizondo, &amp; Krause</td>
<td>Support effects on Hydrogenation of Metal Oxide Supported Catalysts</td>
<td>Chandler</td>
</tr>
<tr>
<td>145</td>
<td>4:30</td>
<td>Guzman</td>
<td>Chiral Selectivity of Organic Superbases</td>
<td>Bachrach</td>
</tr>
<tr>
<td>#</td>
<td>Time</td>
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<td>Mentor(s)</td>
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<tr>
<td>147</td>
<td>3:40</td>
<td>Hogsett &amp; Muñoz</td>
<td>Exploring the Effect of Distal Charges on the Reduction Potential of the Rieske Protein from <em>Thermus thermophiles</em> Rieske Protein</td>
<td>Hunsicker-Wang</td>
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<tr>
<td>148</td>
<td>4:00</td>
<td>Tchen, Nickle, Zurita</td>
<td>Effects of 3-D Microenvironment and Mechanical Properties on the Neuronal Phenotype of HT22 Cells</td>
<td>Munoz-Pinto</td>
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<tr>
<td>149</td>
<td>4:15</td>
<td>Alvarez</td>
<td>Lipid Analysis of Astrocyte Secretion: Change as a Function of Age</td>
<td>Roberts</td>
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<tr>
<td>150</td>
<td>4:30</td>
<td>Clarke</td>
<td>Time-Correlated Single-Photon Fluorescence Imaging of Lipid Raft-like Domains in Giant Unilamellar Vesicles (GUV's)</td>
<td>Cheng</td>
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<tr>
<td>151</td>
<td>4:45</td>
<td>Zaman &amp; Potts</td>
<td>Biochemical characterization of spliceosomal protein Dib1 mutants</td>
<td>Maeder</td>
</tr>
<tr>
<td>152</td>
<td>5:00</td>
<td>Zurita, Nickle, Tchen</td>
<td>Evaluation of the Potential of Collagen-PEGDA Interpenetrating Networks for Nerve Tissue Engineering Using hMSCs</td>
<td>Munoz-Pinto</td>
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**Abstracts**

The following # pages are presentation abstracts. This legend may be used for authors:

Names in **bold** are current undergraduate students.
Names followed by an asterisk (*) are presenters.
Names underlined are current faculty mentors.
Summer Accelerator Program:

The Contemporary

Andrea Acevedo*, Benjamin Collinger, Kassie Kelly, Jessica Cruz, Danielle Trevino, Karina Mendez, & Zabdi Salazar, Dr. Luis Martinez

As The Contemporary, a digital current affairs platform, our mission is to unite the voices of college students across the globe by initiating dialogue on politics, policy, and culture. After competing for and winning the Stumberg competition, we were given the opportunity to participate in a 10-week accelerator program to grow our startup. Our team consists of seven dedicated students with a diverse array of interests and skills.

In the accelerator program, we developed our business plan and learned about the benefits and drawbacks differing legal entities and organizational directions. Throughout the course of the summer we expanded our reach across the U.S. and Europe by recruiting columnists from a wide range of universities. After meeting with mentors in journalism, business and public relations, we began exploring unique ways to engage with our audience and shape our message. In workshops, we learned about innovative business strategies in order to structure our lean canvas model, value proposition, public relations, and facilitate our exploration of the different types of legal entities. This poster will highlight our major accomplishments from the summer program, our aspirations, and the organization’s business model.

Funding Source: Stumberg Seed Competition, Trinity Entrepreneurship
Prostaglandin Expression as a Protective Marker of Gastrointestinal Injury in a Non-Human Primate Explant Model

Nicholas Alana* & Steven Acevedo, Dr. Jonathan King

Dysregulation of inflammatory processes are associated with intestinal injury, necrotizing enterocolitis, and risk of perforation in the newborn. A reduction of Epidermal Growth Factor (EGF) level or abundance and impaired function of the EGF Receptor (EGFR), have been demonstrated in the preterm gastrointestinal system compared to term. Prostaglandin E2 (PGE2) as well as EGF have independently been shown to have a role in barrier maintenance, recovery from injury, and regulation of perfusion.

Evaluate 1) the regulation of EGF/EGFR/PGE2 pathway and 2) the role of inflammatory and anti-inflammatory agents on this pathway in a non-human primate gastrointestinal explant model.

Tissue explants were created from gastrointestinal regions (ileum through colon) upon necropsy of term and preterm (67% gestation) non-human primates. Explants were cultured in media alone or with pro-inflammatory (TNF 10 ng/ml), and anti-inflammatory (indomethacin 50μM) agents. Absolute and relative PGE2 secretion, mRNA and protein expression of Prostanoid (EP) receptor subtypes and EGFR pathway substrates were measured to evaluate the EGF/PGE2 pathway regulation at 24 hours post exposure.

A positive gradient of PGE2 secretion in the distal gastrointestinal regions was observed in term explants compared to the preterm tissue, which had a limited gradient. Absolute PGE2 secretion was significantly increased in term explants compared to preterm, and was significantly more resistant to indomethacin inhibition of PGE2 synthesis.

The pronounced decrease in PGE2 secretion in preterm compared to term tissue across all conditions tested may suggest a limited ability to modulate inflammation and a decreased resistance to gut injury from treatment with anti-inflammatory agents.

Funding Source: Brown Foundation
Lipid Analysis of Astrocyte Secretions: Change as a Function of Age

Cynthia Alvarez*, Dr. James Roberts

Astrocytes are a major type of glial cell that are responsible for the general upkeep of surrounding neurons. They secrete apolipoproteins, which bind lipids that are involved in the basic function of a neuron and serve as a protection against oxidative stress mediated neurodegenerative diseases. Some of the most notable apolipoproteins include apoE and apoA1, which are associated with neurodegenerative illnesses such as Alzheimer’s disease. We aimed to evaluate the composition of astrocyte secretions at different ages of astrocytes (4 and 28 month) to see if there a change in their protective effects on neurons is reflected. The cells were placed in serum free growth medium and it was collected after 3 days. Media purification was done by precipitation with Dextran Sulfate (Cell Biolabs) to separate and concentrate the low-density lipoproteins/ very low-density lipoproteins (LDLs/VLDLs) from the high-density lipoproteins (HDLs) and analyzing the protein concentration from each sample. Cleanascite (Biotech Support Group), a lipid binding resin, was used in a different form of media purification that yielded total lipid content. Western Blots were then used to analyze the protein content from the different lipoproteins from both samples. The lipid content from the media is being quantitatively evaluated using thin layer chromatography and mass spectrometry. It is anticipated that the amount of released lipids will decrease or change in content with age, thereby decreasing the astrocytes’ protective effects on neurons against neurodegenerative diseases, which will be seen by the degree of deterioration of the neurons.

Funding Source: Megabucks Foundation, Ronald E. McNair Postbaccalaureate Achievement Program, & Cowles Professorship
Reduction of *Escherichia coli* Populations by Probiotic Bacilli in Limiting Nutrient Environments

Karina J. Bridges*, Dr. Frank Healy

*Escherichia coli* is one of the most common causal agents of hospital associated infections (HAI). A variety of methods have been developed to reduce the incidence of HAIs such as detergents and chemical disinfectants. However, because microorganisms can adapt to a variety of environmental and physical conditions, a resistance to extensively used antiseptics and disinfectants has recently been reported. In response to this dilemma, probiotics are also being explored as a method to reduce HAI bacteria in clinical settings. This approach presumably relies on the abilities of probiotic microorganisms to outcompete, inactivate, or kill undesirable bacteria in target environments. Chrisal is a commercially available probiotic formulation that has been reported to significantly reduce populations of pathogenic strains of *E. coli* and other bacteria associated with surfaces in hospitals. Chrisal is a proprietary vehicle containing a mixture of strains of *Bacillus megaterium*, *B. pumilus* and *B. subtilis*, though the mechanism at work in the reduction of microbial numbers is unknown. In order to investigate the roles of these bacilli in the reduction of HAI bacteria, competition assays were performed using different pairwise combinations of bacilli and *E. coli* in liquid media with varying nutrient concentrations and initial population densities to assess whether *E. coli* population reductions were due to specific species of bacilli. Following overnight growth of bacterial co-cultures in the different media and population conditions, samples were plated on nutrient agar to determine final bacterial counts and population sizes. Our results suggest that in limiting nutrient conditions, *E. coli* numbers are reduced when grown in co-culture with strains of *B. pumilus* and *B. subtilis* where the initial populations of bacilli are equal to or higher than that of *E. coli*. No clear effects of *B. megaterium* on *E. coli* were observed in liquid media competition assays when these two organisms were grown together, possibly suggesting that this organism may exert competitive effects in different conditions or against other bacterial species, such as *Staphylococcus aureus*. Given the reported efficacy of probiotic formulations on the reduction of clinically important HAI pathogens, further investigation into probiotic/HAI bacteria interactions will be valuable in revealing the underlying mechanism(s) that cause reductions in bacterial numbers.

Funding Source: Ronald E. McNair Post baccalaureate Achievement Program.
Conflict resolution among competing females: How social interactions influence dominance, and dominance influences social interactions

Elizabeth Broussard*, Malcolm Conner, & Danielle Freund, Dr. Troy G. Murphy

Social rank arises from aggressive interactions between individuals and defines a group’s social system. Unlike elaborate traits that signal mate-quality, some species possess characteristics that serve as indicators of fighting ability, and ultimately mediate the outcome of aggressive interactions. Previous work on the American goldfinch (Spinus tristis) supported the hypothesis that females use rapidly changing bill color to communicate fighting ability to rival females. As such, this species is an ideal model system to test the evolution of signals that mediate conflict. We propose that female bill color will both influence, and be influenced by, competitive outcomes of social interactions. Specifically, we hypothesize that social status of female goldfinches will be elevated or depressed by winning or losing competitive interactions.

To test this, we studied hierarchy within nine flocks of eighteen birds in Ontario, Canada. Within these flocks, we observed aggressive interactions over limited food resources. Flocks were then broken down into six triads based on rank, with the top three individuals in the first triad and the bottom three individuals in the sixth triad. One individual in each triad was then socially manipulated; the lowest ranked individual in the three upper triads was switched with the highest ranked member of the lower three triads. This modification of social environment allowed birds who were accustomed to losing within their original triads to win against lower ranked birds, while individuals accustomed to winning were placed in a position to lose against higher ranked birds. Finally, the socially manipulated birds were returned to their original triads, and their dominance was again monitored to test whether they altered their aggressive behavior to match their newly perceived rank. We predicted that those moved to lower-ranked triads would dominate interactions more frequently and would rise in rank among the original social group, while individuals moved to higher-ranked triads would lose and suffer loss in social rank when returned to their original triad. Analyses are underway. If our predictions are supported --that rank and signal expression change with an individual's social environment -- this will provide strong evidence that social rank is fluid and dependent on an individual’s recently experienced social environment. These results would indicate that female aggression should not be considered an unchanging characteristic based off an individual's fighting ability, but should instead be considered an emergent property of an animal's social environment.

Funding Source:  Murchison Fellowship to EB, Biology Summer Undergraduate Research Fellowship to DF, & Hixon Fellowship to MC
Dialectical Behavior Therapy for Adults vs. Adolescents: a Comparative Meta-analysis

Amanda Cantu*, & Alexandra Gamboa, Dr. William Ellison

Dialectical behavior therapy (DBT) is a cognitive behavioral treatment originally created to help women with borderline personality disorder (BPD) obtain a more functional life through acceptance, mindfulness, and skills training. Since its inception, DBT has been modified and used to treat adolescents with maladaptive behaviors. It is still unclear whether DBT is as efficacious for adolescents as it is for adults. We conducted a formal literature search and found twenty-seven DBT studies for adolescents. We matched these with twenty-seven DBT studies for adults that had similar diagnostic inclusion criteria. We conducted a meta-analysis comparing the impact of DBT for adolescents versus adults. The results suggest the average weighted effect size of DBT between groups was Hedges’ g = 0.24. There was no difference in efficacy of DBT for adolescents (g = 0.21) and for adults (g = 0.28), t (14.07) = 0.505, p = 0.62. There was a substantial amount of heterogeneity between studies, I^2 = 48.90. In addition, the average weighted effect size of DBT within groups was Becker’s standardized mean gain = 0.66. There was no difference in effectiveness of DBT for adolescents (mean gain = 0.68) and for adults (mean gain = 0.67), t (42.3) = 0.132, p = 0.90. There was also a substantial amount of heterogeneity between studies in the within group effect, I^2 = 81.18. Accordingly, clinicians can be confident that DBT used to treat adolescents will have similar benefit as for adults.

Funding Source: Ronald E. McNair Post baccalaureate Achievement Program.
The role of testosterone in signaling aggression and the emergence of dominance among female American Goldfinches

Vladislav Chalenko*, Dr. Troy G. Murphy

Competition over limited resources such as food and mates is pervasive in nature. Some individuals rise above others and exert their dominance, while others contribute few copies of their genes to the next generation. Although it is well established which factors contribute to the emergence of dominance among males, little is known about the mechanisms leading to female competitive outcomes. Female American Goldfinches (*Spinus tristus*), are excellent candidates for studying dominance because they are known to use 'status signals' to communicate their dominance during same-sex contests. The female bill color is a meaningful signal of fighting ability because the carotenoids required to brighten the bill are limited and only the highest quality individuals can afford to use that resource to brighten their bill. Previous work has shown that female bill color reflects an individual’s current health, immunity, and recent stress. We are interested in testing whether female bill color also functions as a meaningful signal because color expression is causally linked to testosterone, an androgen hormone known to mediate aggression in females of some avian species. We hypothesize that female goldfinches with more testosterone will be more aggressive and will have more colorful bills. To test our hypothesis, we conducted three separate but related experiments. For the first experiment, we implanted half of our experimental females with a slow-release testosterone tubule, and implanted the other half with placebo implants. We conducted dominance trials, where we pitted a testosterone augmented female against a control female as they competed for limited food. The second two experiments were designed to provide additional information on the role of female bill color as a status signal. In experiment two, one bird of each dyad had their bill augmented with an orange marker, while the other bird in the dyad had their bill dulled with grey marker. Again, we conducted dominance trials, where we pitted a color-augmented female against a color-control female as they competed for limited food. The third experiment was very similar to the second except that one bird of each dyad was not dulled, but rather left alone in its natural bill color. Video analyses are underway. We expect that birds supplemented with testosterone and birds with bill color augmentation will dominate their partners. If our predictions are supported, our research will provide strong support for the hypotheses that female aggression, like male aggression, is mediated by testosterone. Furthermore, we would demonstrate that a female signal of dominance can directly communicate an individual's aggressive state, which would provide receivers with highly reliable information about the current risk associated with engaging a rival.

Funding Source: Summer Vivarium Research Internship
Students + Startups: Using Computer Science in Industry

Stephen Chang*, Dr. Erin Hood & Ryan Ward

The Students + Startups Summer Internship program is designed to give Trinity students industry experience by working with local startup companies. Working with a small company allowed me to use computer science in a variety of different and industry-relevant ways.

I worked with Scraffic Traffic Counting, a subsidiary of Westward WFM, a retail solutions company. Scraffic builds and sells retail traffic counters, which count the number of people entering and leaving retail stores. I learned how to work alongside others in a professional setting and the strengths and limitations of computer science in industry. At the beginning of the summer I made four learning objectives that pointed me in the right direction for the summer, since I believe that the main goal of the program is for the students to further their learning and education in an environment different from the classroom. These learning objectives helped keep me on the right track to learn the relevant things as much as I could, as well as to understand the importance of what I worked on. This poster will focus on those learning objectives and the work necessary to complete them.

Funding Source: Trinity Students + Startups and Westward WFM
The Better Student Program: Tapping peer tutor potential to enhance the First Year Experience

Bev Chatfield*, Sophia Abbot & Dr. Anne Graf

My mentors and I are researching the role of the peer tutor in Trinity University’s First Year Experience courses in hopes of better understanding the experiences of the peer tutors and identifying ways to further improve the new FYE program through them. In Spring 2016, my mentors gathered information from the 2015 FYE peer tutors through a focus group and an anonymous survey. Upon reviewing this data over the summer, we found that what peer tutors loved most about tutoring was being able to help students and see them improve. We also found that most peer tutors were disappointed when the first years interacted with them less than they had expected. It seems that my fellow peer tutors share the sentiment I’ve had over my past two peer tutoring experiences: we want to give the first years as much help as we can but how do we get them to come to us? After reviewing additional external literature on peer tutoring, I found that most tutoring programs face challenges regarding ambiguity of the role of the peer tutor. When students don’t know the ways in which their tutor can help them, they avoid asking for help at all. In order to clarify the role of the peer tutor, identify them as knowledgeable resources in the FYE community, and encourage a regular meeting time outside of class for first years to interact with their peer tutors, I developed a proposed program called the Better Student Program (BSP) in which FYE peer tutors facilitate a weekly study group for their FYE section. Through small group activities followed by an hour of studying in quiet proximity, the Better Student Program would reinforce course content and prepare the first years for the rest of their academic careers at Trinity by teaching them how to be proactive students.

Funding Source: Mellon Initiative
A.L.E. Summer Internship: 
OPERA San Antonio

Susan Clark*, Dr. Carl Leafstedt

The Arts, Letters, and Enterprise (A.L.E.) Summer Internship program has been a once in a lifetime experience that would not have been possible without the extreme generosity of Trinity University and its supporters. This program was created for students in the humanities and sciences to gain real-world exposure and valuable learning experiences. The time that I’ve had with OPERA San Antonio has given me the educational experiences that will propel my success in the professional world.

As the Administrative Intern at OPERA San Antonio, I had the opportunity to engage in a wide array of duties ranging from social media marketing to database management to education. The experience of working in a small environment was very enriching and educational, as I now have a deeper understanding of the small business and nonprofit world, and have since developed a passion for this type of work. I formed five learning objectives prior to my internship, and this in turn has allowed for me to be more cognizant of the educational value behind my day-to-day tasks and office work. These five objectives—professional communication, networking, grant-writing, office technology, and marketing—will be highlighted in this poster.

Funding Source: Arts, Letters, and Enterprise Program
Modeling the Effects of ZO-1 Protein Expression on Epithelial Cell Migration

Hannah Cook*, Christina Nielsen*, & Ryan Reynolds*, Drs. E. Cabral Balreira, Dr. J. Roberto Hasfura-Buenaga, & Dr. Jonathan M. King

Tight junctions are important proteins in epithelial cells aiding in sheet formation and regulating solute diffusion across the layer. Zonula Occludens-1 (ZO-1) is an essential component of the tight junction scaffolding barrier proteins within the actin cytoskeleton. A study by Waters et al. (2003) implicated ZO-1 protein knockdown as an important element in cell migration. We employed the classic MDCK epithelial cell line with endogenous and knockdown levels of ZO-1. These lines were transfected with a fluorescent mApple-Histone-2B construct to measure cell density in real-time. In addition, we investigated the role of proliferation in cell migration by using an in-vitro simulation of MDCK cell wound repair and proliferative cell immunofluorescent staining to address if MDCK cell migration displayed a significant amount of proliferation.

Confluent MDCK monolayers were wounded and migration was visualized using real-time confocal microscopy. Waters et al. (2003) also suggested an initial stage of cell migration which can be mathematically modeled by diffusion. Our suggested model proposes that the migration transitions to a transport in a second stage and thus we introduce a convection-diffusion model for migration. The parameters for this model are the diffusivity coefficient and velocity for transport. We considered two models for the coefficients, either constant or a stepwise function at a transition time switching the model from diffusion to transport. The parameters of the models were fitted using Least Squares optimization.

We found the diffusivity coefficient, velocity, and total distance traveled were higher in cells with knockdown levels of ZO-1 compared to cells with endogenous ZO-1. This is consistent with our predictions that ZO-1 plays an integral role in differentiating and binding the cells. Our model suggests that cells with knockdown ZO-1 expression are able to proceed through epithelial-mesenchymal transition (EMT) more rapidly and spread from one another more easily. Thus, they are able to move faster and farther than the endogenous ZO-1 cells.

Funding Source: National Science Foundation Award # DMS-0926702
Using your muscles to attract a mate, lizard style: Muscle physiology and social behavior in Caribbean anoles

Faith M. Deckard*, Dr. Michele A. Johnson.

Behavioral movements are not possible without muscular contractions, and in turn, the behavioral use of a muscle can influence the structural and biochemical traits of the muscle. For example, the size of the fibers that compose a muscle, or the types of fibers that compose the muscle (fast or slow twitch; oxidative or glycolytic), may be associated with the frequency or duration of the contractions of that muscle. In this study, we examine how muscle fiber type and size work together to create movement. To this end, we collected field observational data on three closely-related pairs of Anolis lizard species from the Dominican Republic. The lizards in each pair share similar morphologies and structural niches, but they differ dramatically in their display of a colorful throat fan called a dewlap. More specifically, the Anolis chlorocyanus, Anolis brevirostris, and Anolis longitibialis have long, but infrequent dewlap displays, while their respective counterparts, Anolis coelestinus, Anolis distichus, and Anolis cybotes, have shorter, more frequent displays. We predict that these differences in dewlap extension behaviors are associated with differences in the fiber type and size of the ceratohyoid, the single muscle responsible for dewlap extension. Through a multivariate analysis, we will gain a better understanding of the muscular physiology underlying the evolution of social behavior.

Funding Source: Ronald E. McNair Post baccalaureate Achievement Program, National Science Foundation IOS 1257021 to M. A. Johnson
Motility Responses of *Escherichia coli* to Chemoeffectector Attractants and Repellents

Reann Esparza*, Dr. Frank Healy

Sensory transduction is vital to the function of all biological systems. Detailed systematic and mechanistic studies of the process using simple model systems can provide broad and fundamental insights into many aspects of the phenomenon. The bacterium *Escherichia coli* produces a large sensory array on its surface consisting of several receptor proteins (MCPs) that it uses to swim through its environment in the quest for food or in the avoidance of unfavorable habitats. The mechanism behind chemoeffectector attractant recognition by sensory receptor proteins that causes straight line swimming behavior is rather well understood, whereas relatively little is known regarding the mechanism of repellent signal transduction that results in tumble responses by the cell. We intend to explore this latter area through the characterization of signal transduction components with altered behavioral responses to repellent compounds. Here we report the use of a chemical-in-plate assay for the characterization of dose-dependent motility responses by populations of *E. coli* cells to attractant amino acids and metal salt repellents. Wild type *E. coli* K12 strains exhibited readily observable taxis responses toward attractant and away from repellent chemicals. Two *E. coli* MCP deletion mutants (Δtar and Δtsr) were also tested for repellent responses using motility assays. In these experiments the Δtsr mutant responded normally to the repellent cues we tested; however, the Δtar mutant failed to elicit repellent responses to metal salts. With this functional assay in hand we can now begin to identify and characterize sensory transduction components (MCPs, binding proteins, transporters, etc.) that participate in the cell’s response to repellent stimuli in an effort to better understand repellent sensing mechanisms in the process of signal transduction by the cell.

Funding Source: None
Prussian Blue - With Our Hands

Sasha Faust*, Dr. Jessica Halonen

My creative research and artistic presentation focuses on the history of Prussian blue, the first synthetically produced pigment. Discovered by accident in 1706, Prussian blue had an instant impact on the world of painting, but its influence reaches far beyond the art world. This extraordinary compound was instrumental in the beginnings of photography and though it can be used as an antidote to some heavy metal poisonings, it also led to the discovery and production of Zyklon B the poison used in Nazis gas chambers.

My project With Our Hands uses cyanotype, an alternative photographic process, to produce Prussian blue images that engage with the history of this pigment. The works in this series utilize objects and imagery that reference my family’s escape from Poland during World War II. They speak to the complex role of Prussian blue in shaping my family history and our world.

Funding Source: Megabucks Foundation
Predicting Geographic Ranges of Small Mammals: Lessons from Multiple Species

Heather Finch*, Madeline Petri*, & Zachary Wooten*, Dr. Saber Elaydi, Dr. Roberto Hasfura & Dr. David Ribble

Species distribution models (SDMs) predict the geographic distribution of a species based on previous locations of the species and correlations with environmental conditions. Our research team has developed a method to expand on previous models by approximating the growth rates of field mice (*Peromyscus*) from collection data and using these growth rates along with existing environmental parameters (temperature, precipitation and elevation) to calculate species distributions. In this study, we tested our SDM on different species of *Peromyscus*. We compared our results to other SDMs, such as Genetic Algorithm for Rule-set Prediction (GARP), to determine the effectiveness of our own SDM. We assessed the accuracy of our model using Receiver Operator Characteristic (ROC) curves, and area under the ROC Curves (AUC). The ROC results support the use of our SDM in predicting *Peromyscus* distributions compared to other SDMs. We will review the predictions of our model as it relates to the various life histories of these species, and how the model predicts the impact of global climate changes on mammalian species distributions.

Funding Source: The National Science Foundation (NSF)
Building the Steps towards a Career in Theatre: An ALE Internship at The Playhouse

Holly Gabelmann*, Dr. Stacey Connelly

The Arts, Letters, and Enterprise (ALE) Summer Internship program connects ALE minors with internships at local nonprofits. One such nonprofit is The Playhouse whose mission is to provide quality theatre to San Antonio. Founded in 1912, The Playhouse has a history of serving the area through educational programs, including several internship opportunities. Through such an internship, I gained the skills and connections needed to pursue a career in theatre.

Like the stairs I helped to construct during my time in The Playhouse scene shop, my internship had three components. Just as the stringer—a piece of wood that holds stairs together—guides the structure of the steps, goals gave my internship shape. My primary goal was to learn how a theatre is run through experience with the production process. Thus, I worked in a variety of capacities: as a scene shop technician, camp assistant, and office intern. These experiences I consider the risers—the fronts of the steps—of my internship, as they reinforce the lessons learned during my summer. Finally, the lessons serve as the treads, or steps, of my internship staircase. Working with The Playhouse helped to refine my interests and develop the flexibility needed to work in a professional setting; the skills I gained are steps towards building a career. Through the metaphor of the staircase, my poster will examine both my learning goals and the steps I took to complete them.

Funding Source: Arts, Letters, and Enterprise Minor
Students + Startups Summer Internship Program: Coding, Diversity, and Entrepreneurship

Daniela Galarza*, Dr. Luis Martinez

The Students+Startups Summer Internship program is designed for students to gain work experience through an internship with a local startup. While this program was born in the entrepreneurship department, the variety of internships allows this program to be offered to all students regardless of their major. As a Management, Marketing and Entrepreneurship major I was looking for an internship experience that would allow me to tap into all three academic areas while engaging in real-world projects. Working in a startup requires flexibility and adaptability; regardless of what your main role is, you take on a bit of everything. For this reason, I find the experience invaluable and very enriching for our careers.

The position I had at CodersLink was marketing and sales based. CodersLink is a reverse recruiting tech talent agency that connects US companies to the best software engineers in Mexico. The main purpose for my internship was to generate leads; whether it’d be through direct sales or through marketing efforts. I believe that I was able to fulfill most, if not all, of the learning objectives I set myself at the beginning of the internship. These goals included enhancing interpersonal communication skills, applying concepts that I have acquired from all of my majors, and obtaining first hand experience from working in a startup environment. I not only expanded my network in San Antonio but also in the Austin area, and I familiarized myself a bit more with the tech industry. I can confidently say that I made a positive impact in the company I was working for, which was one of the main goals I set for myself. The poster will highlight how I have been able to work on these goals by explaining what I did in the company and how it is related to them, while always coming back to the overall impact.

Funding source: Experiential Learning
Is DBT as Effective in the Treatment of Eating Disorders Compared to BPD: A Meta-Analysis

Alexandra Gamboa* & Amanda Cantu, Dr. William Ellison

Dialectical Behavior Therapy (DBT) is a cognitive behavioral treatment originally designed for the treatment of individuals with Borderline Personality Disorder (BPD) (Linehan, 1993). It has since been adapted to address other problems that share the features of emotional dysregulation, interpersonal difficulties, impulse control, and instability of self-image that DBT was designed to target. For example, promising results have been found for the use of DBT for eating disorders. This meta-analysis aimed to determine whether DBT is as suitable a treatment for eating disorders as for BPD. Database searches and manual reviews of relevant journals were conducted resulting in 38 articles that met inclusion criteria. This meta-analysis resulted in a weighted between-groups effect size of Hedges’ $g = .39$. There was no difference between the efficacy of DBT for BPD ($g = .40$) as for DBT for eating disorders ($g = .37$), $t (5.24) = .116$, $p = .91$. A large amount of between-studies variance remained, $I^2 = 79.11$. The weighted within-groups effects size was a Becker’s standardized mean gain of .633. This analysis also showed that there was no difference in the effectiveness of DBT for BPD (mean gain = .69) and for eating disorders (mean gain = .61), $t (33) = .95$, $p = .35$. A large amount of within-groups variance, $I^2 = 73.44$ was also found. These results point towards DBT being as suitable a treatment for eating disorders as BPD. Further research should look at whether DBT is as equally as effective for all types of eating disorders.

Funding Source: Office of the Vice President for Academic Affairs-Budget and Research
How well do children learn verbs from LESS noisy data?

Claudia Garcia*, Shea Voss*, Blaire Porter, Andrea Lee, Nick Thies, Carl Warren, & Victoria Ramos, Dr. Jane Childers

Children learning a new verb must segment dynamic scenes and link different elements within those scenes to specific verbs. Most prior verb studies have included only relevant events. Structural alignment (SA) theory (e.g., Markman & Gentner, 1997) predicts that events with few alignments will be discarded and thus, children should be able to overlook irrelevant events and focus on relevant ones.

Study 1 asks how children compare events during verb learning when naturalistic backgrounds are shown and some events are irrelevant. This is an important question because events that could be compared to each other usually are interleaved with other events. Two ½- and 3 ½-year-olds (n=32) were randomly assigned to a Target First (TTDDT), Distractor First (DTDTT) or Alternating (TDTDT) condition, and learned two verbs. The event stimuli included a more complex background to better simulate the kinds of scenes children are viewing when they see events. Two sets of events were created in a kitchen and two took place in a park. The study began with 2 warm up trials and then experimental trials. When seeing a relevant event, children heard “Look! She’s gonna <verb> it! She’s <verb>ing it. She <verb>ed it.” When seeing a distractor event, children heard “Now look at what she can do. Wow! Look! ” during the event. These phrases were repeated until the child had seen 5 events. In the test phase, immediately before the test trial, children heard “Now it’s your turn to find <novel verb>ing,” and then saw two scenes in a split screen while hearing “Which one is <verb>ing it? Can you show me? Can you point to it? Where’s she <verb>ing it?” The learning and test phase formed a single block of trials. The entire process was repeated until children had completed a block of trials for two novel verbs. Children’s pointing behavior at test was coded as Correct or Incorrect or No Response.

Funding source: Trinity University Psychology Department, Mach Foundation
Revolutionizing the Business of Music

Benjamin Gomez*, Dr. Ben Hodge

The Students + Startups Summer Internship program is designed for Trinity entrepreneurship minors seeking real world experience in the San Antonio startup scene. This program pairs students with local startup companies based on their interest. This summer, I was able to sharpen my skills as a marketing/management major, and a hopeful Entertainment Business major with the company Event Escrow.

Event Escrow is an events management platform launching in July of 2016 that aims to be the online liaison between bands and venues. It works to help secure bands gigs through statistical analysis of popularity, and ensures that both the band and venue fulfill their duties. I worked on the marketing, event production, and artist relations of this start-up. Therefore, my internship with Event Escrow required me to be both flexible, organized and constantly network with music and business professionals in the San Antonio area.

At the beginning of the summer, I developed four learning objectives that I continued to reflect upon throughout the summer. These included: learning large festival/event planning, learning about the process of securing sponsorship dollars, learning to use team collaboration software, and learning elementary website coding. These four objectives helped to guide my summer research and overall experience with Event Escrow, and allowed me to relate this internship to my career goal of becoming a talent buyer for large-scale events, or an agent for national touring acts.

Funding Source: Event Escrow, Trinity University, 80/20 Foundation
Students and Startups had its first session this summer. An early introduction to startups is essential in students’ development as businessmen and women. It did a great job of connecting students with startups who are focusing on issues of interest and that could provide a meaningful real world feel of what is expected of students in small companies. As a Business Analytics and Technology major working, in a startup gave me a chance of deploying my skills in a real life setting with real pressure. I interned with MassVenture.

Working in a startup requires you to go back and forth between activities that require different skill sets. The work is hectic and often does not follow a line due to complications that arise. This was a little problematic because our learning objectives seemed to take startups as a static entity when they are not. Week in and week out I would shift between projects that required technical abilities to some that were mostly analytical. Overarching goals that I achieved that where part of my objectives: improved upon my skills in Excel and WordPress, both of which are very important skills to have for any job or career now a days. On the business side I learned important finance skills, specifically analyzing financial statements such as balance sheets and make decisions on a property’s investment opportunities. I also learned business development skills by trying to identify ways to grow MassVenture while finding and keeping true to our vision and identity. In my poster I will discuss these four objectives I set out initially and achieved throughout my internship.

Funding Source: 80/20 Foundation and MassVenture
Students+Startups: 
Rackspace: Open Cloud Academy

Austin Guerrero*, Dr. Erin Hood, Marcus Benavidez & Whitley Chambers

The Students+Startups summer internship program was built to give students a free seamless integration of what they have been learning in the classroom, or what they aspire to learn, by matching them up with a start-up company. These liquid environments help the students, like myself, learn and engage in all different parts of the business about tasks we expect to do when we’re older, and don’t expect to do. Specifically, the Open Cloud academy has provided me with data analytics practices and business savvy I will carry with me throughout my career.

My position with Rackspace: Open Cloud Academy required me to complete a wide range of assignments. At the beginning I developed learning goals with Marcus and Whitley that included data entry, anything/everything excel, design, speaking, customer service and teamwork. My poster will highlight how I developed my learning objectives throughout the summer and how these objectives guided my tasks throughout the summer. The poster will also display some of the tasks that I completed that fell under each learning objective category.

Funding Source: 80/20 Foundation, Open Cloud Academy
Sexual selection in *Anolis* lizards: An analysis of sperm and testis morphology

Hannah R. Hall* & Ariel F. Kahrl, Dr. Michele A. Johnson

Sexual selection acts on an organism’s ability to successfully obtain mates, either through intersexual selection, generally via female choice of males, or intrasexual selection, where males compete against each other for access to females. Male competition for mates can occur both before and after copulation, but the relationship between these two types of competition is unclear. Stronger pre-copulatory male competition generally leads to greater sexual size dimorphism (SSD), with males growing to larger body sizes than females, while the strength of post-copulatory selection is often associated with testis and sperm morphology. To better understand the dynamics between these pressures when they are both present within the same individuals, we examine 30 species of *Anolis* lizards from Puerto Rico, Bahamas, the Dominican Republic, and the United States. Using cryosectioned testis tissues, we will measure the cross-sectional areas of the testis, the seminiferous tubules, and the lumina of the tubules. We will also measure the ratio of spermatogenic to somatic cells within the testis. We will then determine relationships between these measures of testis architecture, relative testis size, and SSD. In addition, we will also examine relationships between these traits and the head and midpiece morphology of mature sperm across species. We predict that species exhibit trade-offs between pre- and postcopulatory selection, such that species that invest more in male growth (i.e., greater SSD) will have fewer resources to allocate to sperm and testis development. This study will help us understand how sexual selection influences the evolution of reproductive morphologies in lizards.

Funding Source: National Science Foundation IOS 1257021 to M.A. Johnson
Microbial Community Studies of Sediment Samples from the San Antonio River

Lydia K. Hobbs Woodruff*, Dr. Frank Healy

The San Antonio River is a 240 mile long body of water that extends from the Blue Hole and to the Guadalupe River. It is an important source of tourism revenue and serves as a habitat for many native species. The major input for the river comes from treated wastewater originating from SAWS (San Antonio Water System). The San Antonio River Authority (SARA) has conducted longitudinal analyses of the chemical and biological composition of the river for over 75 years, and the reported data show that the numbers of *Escherichia coli* are higher than desirable for river health and recreation. On the other hand, little is known regarding the microbial community composition of sediment in the San Antonio river. The goal of this work is to begin to characterize sediment samples and determine whether sediment is a significant reservoir of *E. coli*. To address these questions, river sediment samples were collected from three sites of interest and used for bacterial enumeration and screening for the presence of *E. coli*. Heterotrophic bacterial numbers were measured from serial dilutions of sediment samples on nutrient agar of varying composition. In order to determine *E. coli* counts in samples, a fluorescence-based plate assay was used with the fluorogenic substrate methylumbelliferyl-beta-D-glucuronide (MUG). To characterize microbial community diversity, oligonucleotide primers designed to amplify variable regions of 16S rRNA genes were used in PCR assays of total community DNA samples extracted from sediment. MUG plate assays resulted in the identification of 25 clones expressing MUG hydrolysis activity from initial screens of ~ 8 x 10^4 sediment bacteria (frequency of MUG hydrolyzing bacteria ~3.12 x 10^-4). Further confirmatory tests are underway to determine whether MUG+ isolates are *E. coli*. In comparison with SARA data for microbial numbers in water, our preliminary findings would suggest that sediment is not a significant source of *E. coli* in the San Antonio River.

Funding Source: Hixson Environmental Studies Research Fellowship.
Interning at San Antonio River Authority: A Little Bit of Everything at a Driven Government Agency

Alex Holler*, Dr. James Shinkle

The San Antonio River Authority (SARA) is a governmental agency responsible for preserving, protecting, and managing the resources and environment of the San Antonio River and its tributaries. Among its many responsibilities, SARA oversees recreational areas along the river, collaborates on building and maintaining flood mitigation devices, conducts water quality testing, and manages several wastewater treatment centers. Its mission is to protect and enhance our creeks and rivers through service, leadership, and expertise; its vision is to inspire actions for healthy creeks and rivers. The Intergovernmental and Community Relations office at SARA, where I interned, organizes both internal and external communication between SARA employees, city government officials, and the citizens of San Antonio.

During my internship in the IGCR office at SARA, I was able to put my education in environmental sciences and policy to work, learning a great deal about watersheds, water treatment, sustainability, public education and outreach, and low impact development, as well as communicating this information to others. As per my goals at the beginning of the summer, I completed a wide variety of tasks over the course of the internship, including the following: assisting with preparing and running community outreach and education events; attending staff meetings and conferences to learn more about SARA’s structure and strategies; conducting research on recent code law, related organizations, best practices, and other relevant information; organizing and creating reference documents and photos; visiting the State Capitol to listen and take notes on interim Senate hearings; and attending other events (such as luncheons, tours, and grand openings) as a SARA representative.

Throughout the summer, the supportive, motivated, and trusting workplace atmosphere fostered my responsibility, reliability, integrity, and professional communication and conduct skills. My time at SARA has granted me workforce experience in a passionate and driven governmental agency, and one that I am very proud to have been a part of.

Funding Source: Arts, Learning, and Enterprise Program
Best propagation methods for *Asclepias spp. asperula, incarnata, speciosa, syriaca, viridis, tuberosa, and oenotheroides*.

Lavanya Hospeti*, Olivia Roybal, & Molly Lenihan, Dr. Kelly Lyons

Milkweed plants (*Asclepiadaceae*) are currently of great interest in North America due to their importance in monarch butterfly (*Danaus plexippus*) conservation. Each year, monarchs complete an approximately nine month round-trip migration from Central Mexico to Canada, spanning at least three generations. During the migration, butterflies oviposit exclusively on milkweed species. Once hatched, the larvae feed on milkweed leaves, sequestering poisonous cardenolides, which act as a predator defense mechanism. While there are high levels of interest in milkweed propagation among citizen scientists as well as government agencies, there exists no comprehensive guide to growing individual species. Our goal is to review guidelines for growing various species of milkweed provided by nature organizations, horticultural journals, periodicals, and personal accounts published online and provide professional and amateur growers a document summarizing the best practices in the field. We aim to identify the best-growing practices for antelope horn milkweed (*A. asperula*), swamp milkweed (*A. incarnata*), showy milkweed (*A. speciosa*), common milkweed (*A. syriaca*), green milkweed (*A. viridis*), butterflyweed (*A. tuberosa*), and hierba de zizotes (*A. oenotheroides*). These species were selected due to their native status, putative preference by monarch butterflies, and widespread use in restoration. This accessible and inclusive guide on milkweed propagation will be made available for widespread use for individuals involved in the monarch conservation effort. Our findings for the six species in this study will be presented.
Investigating the Relationship Between Food Insecurity and Negative Psychological Outcomes

Clara Johnson* & Brigitte Taylor, Dr. Keesha Middlemass & Dr. Carolyn B. Becker

Significant research supports the association between food insecurity (FI) and obesity, while little to no research explores the relationship between FI and eating disorder (ED) symptomatology. FI often involves dietary restriction (i.e., reduced intake of food), a behavior linked to ED risk factors. In addition, research on rats demonstrates that both dietary restriction as well as the presence of highly palatable food (HPF) increase the risk of binging behaviors. Populations with high FI typically live in low-income areas with limited healthy food options and an excess of HPF vendors (i.e., convenient stores and fast food restaurants). In order to test these relationships, we recruited 248 San Antonio Food Bank clients to complete our questionnaire with measures of FI, ED symptomatology, and other negative psychological outcomes. We expect that dietary restriction and the abundance of HPF increase the risk for binging behaviors and other ED symptomatology. We expect to find a relationship between FI and EDs such that higher levels of FI are associated with higher levels of ED symptomatology.

Funding Source: Murchison Research Fellowship; McNair Scholars Program; H.E.B; Trinity University Psychology Department
ALE Summer Internship: A Look into the Business Side of the Nonprofit Sector

Ally Karagas*, Dr. Jacob Tingle

The Arts, Letters, and Enterprise (ALE) Summer Internship program aims to help Trinity students in a variety of fields to develop skills and experiences while working alongside local businesses and organizations. As a sociology major, I was unfamiliar with anything related to the business sector. However, during my internship with Burnam | Gray LLC, I was able to use the research and analytical skills I have acquired as a sociology major to guide me as I learned other necessary skills I need in order to succeed as a professional.

At Burnam | Gray LLC, I worked with several local nonprofit organizations: BigGiveSA, EarnABike, Thrive, Texas IDR, Trinity Religion Department, and San Antonio Mayor’s Office. During my time with Burnam | Gray, I was able to get a sense of what all is needed and required in order to run both successful, and unsuccessful, organizations in the modern economy. Through the projects with these organizations, I learned the importance of networking, using statistics to drive decision-making, as well as being an effective communicator. This poster will help portray these skills, as well as some of the projects that I worked on.

Funding Source: Arts, Letters, and Enterprise Minor
Students and Startups Summer Internship: MilTribe

Bintee Karia*, Dr. Erin Hood

The Trinity University Students and Startups Internship is a program designed to connect Trinity students with local entrepreneurs at Geekdom. Through this program I was connected to MilTribe – a startup that is a combination of peer-to-peer platform and a local-deals platform. MilTribe is centered on the idea of making Permanent Change of Station (PCS) easier. Our website allows military families to buy and sell things locally within a community that they trust, while also providing platform for businesses to market to the military by providing exclusive deals to them, available only on our website.

My internship with MilTribe required me to carry out Military Demographic research in order to provide data for creating psychographic profiles as well as helping with other parts of the business such as Beta testing and marketing. This real world application allowed me to apply skills learnt as a Liberal Arts student and a Major of Economics. Moreover, this internship gave me the ability to try out multiple paths while at the same time learning about how entrepreneurs built their companies and making useful connections. I developed four learning objectives at the beginning of the internship, and in this poster I will present how these aligned with the daily work I carried out as an intern.

Funding Source: San Antonio 80/20 Foundation & MilTribe
Bacterial Chemotaxis: Models and Experiments

Danielle King*, Kristen Rundstein*, & Melissa Whitman*, Dr. Hoa Nguyen, Dr. Frank Healy & Dr. Hakan Basagaoglu

Motile bacteria such as *Escherichia coli* sense and respond to chemical concentration gradients through interactions between chemoeffectors and cognate receptor proteins. These interactions initiate signal transduction events that govern the direction of flagellar motor rotation. Motor rotation activity in turn controls whether the organism will change its current direction of travel or continue to run in the same direction. While bacterial cells exhibit active responses to environmental stimuli, the fluid environment also exerts forces on chemotactic organisms as well as passive particles which affects the trajectories of these cells and particles. We are interested in developing computer models and experimental methods to better understand the behaviors of chemotactic bacteria and passive particles. Our computational approaches implement lattice-Boltzmann (LB) and coupled LB RapidCell models to simulate the behaviors of particles and chemotactic bacteria in a variety of fluid/chemoeffector environments. These include Newtonian/non-Newtonian and stagnant/flowing fluids as well as competing chemoeffectors. In competing chemoeffector simulations, we found bacterial motility to be governed by receptor sensitivity rather than attractant concentration. We are validating simulations using quantitative capillary-based chemotaxis assays with suspensions of motile *E. coli*. In these experiments, we have found bacteria to preferentially swim into glass capillaries containing a flowing gradient of amino acid attractant and are currently optimizing the assay to investigate how cells respond to multiple adjacent gradients of different chemoeffectors.

Funding Source: National Science Foundation
A View from City Hall: My Time Interning in Local Government

Tanner Kohfield*, Dr. Jacob Tingle

This summer, I had the honor of completing an internship at The Office of Mayor Ivy Taylor. This internship was coordinated through Trinity’s Arts, Letters, and Enterprises program. In keeping with the mission of this program, I was able to apply my majors (Economics and Political Science) in a practical setting that allowed me to grow as a future job candidate and as a person. My primary role at the internship was helping plan the Mayor’s Housing Summit, a city sponsored summit that brings together the best minds from the housing field to collaborate and solve complex issues. This poster will examine the skills I have gained and the lessons I have learned during this experience.

One such skill is interpersonal communication. Throughout the summer, I was a liaison between the government, non-profit organizations and businesses, which allowed me to apply and hone my knowledge of written and verbal communication. I was also tasked with giving my recommendation on topics and issues of importance, requiring diligent and analytical research that culminated in fact-based decision making. Finally, I was given the opportunity to see the local government work hand-in-hand with non-profits and businesses to solve complex problems that impact the community. This gave me an insight into how to successfully build and nurture these collaborations.

Funding Source: Arts, Letters, and Enterprises Minor
Relevance of Short Wavelength UV-B Radiation to Regulation of Plant Growth in Natural Light Environments

Kendall Kotara*, Dr. James Shinkle

This study was conducted to evaluate the differences found in plant growth due to short wavelength UV-B radiation (280-300 nm) in regards to natural light environments versus greenhouse studies. This summer’s efforts expanded on previous work for this project by incorporating additional native Texas grass species and accounting for differences in UV-B radiation due to variations in natural environment altitudes. Field and greenhouse experiments were conducted on Sideoats Grama (*Bouteloua curtipendula*), Little Bluestem (*Schizachyrium scoparium*), and Big Bluestem (*Andropogon gerardi*). To test the effects of shortwave UV-B in the field, two exclusion treatments were used: Aclar, which allowed all UV radiation, and cellulose acetate, which blocks shortwave UV-B radiation. Greenhouse tests were conducted by treating grass species with supplemental UV, which either included or excluded shortwave UV-B. Reflectance spectra and UV absorbing pigments were used as measures of growth and biochemical and cellular responses to UV-B. UV spectrums were also recorded at field sites and at Trinity University to compare UV spectrums in rural versus urban settings. It is predicted there will be greater differences between species receiving full solar spectrum and those receiving sunlight with radiation of wavelengths shorter than 300 nm removed; the differences are expected to be greater for the trial in rural settings than for the plants placed in more urban locations. Results from the greenhouse trials displayed 2 different responses to supplemental UV-B radiation: decreases in UV-B absorbing pigments in Sideoats Grama and Big Bluestem, while Little Bluestem increases the amount of UV-B absorbing pigments.

Funding Source: Texas Ecolab
The Student+Startups Summer Internship Program is designed for students of any major seeking to experience the thriving Startup culture of San Antonio. Through the program, I interned with Jungle Disk. Jungle Disk develops software and solutions that protects small-mid size business data. My internship focused on data analysis and research, along with working on practical marketing tools that businesses use in today’s time. This acted as a good balance between research experience and real-life work environment. In other words, I was able to apply and enhance analytical skills I have acquired through my Theoretical Economics major.

My internship experience required data-driven research into target customers. I learned about marketing automation, and worked with drip marketing tools such as Pardot and Salesforce. I also became familiar with Software As A Service (SaaS) business marketing tools such as Google Analytics, AdWords, Hotjar and Spyfu. I worked closely with the Principal Data Scientist for Jungle Disk, Michael DeFelice, on various data analytics tools including Python’s data analysis package, Pandas.

This poster will highlight goals I accomplished through my learning objectives, namely: Learn and work with marketing tool, Pardot, and how it works with Salesforce; enhance data analysis skills using Python to effectively appeal to the target consumers; build familiarity with additional SaaS business marketing tools (e.g. Google Analytics, Adwords, Hotjar, Spyfu.); and learn about data threat protection

Funding Source: 80/20 Foundation, Jungle Disk LLC
Uptake 2 blockade by Berberine enhances sociability

Kiran Lalani*, Corey M. Smolik1, Timothy Pham1,3, Alicia Sanchez1, & Dr. Georgianna G. Gould1

1 in 68 individuals in the United States under the age of eight are diagnosed with an autism spectrum disorder. The underlying causes of this developmental disorder are unknown, two core clinical features, restrictive repetitive behaviors and social interaction impairments, are used to diagnose the disorder. With impaired social behavior, it can manifest in several forms, including indifference to social engagement, social anxiety or empathy deficits. The relative lack of therapeutic efficacy of selective serotonin reuptake inhibitors (SSRIs) to improve social behavior has brought into question their utility as a treatment for autism. Given these limitations associated with treating sociability deficits by targeting the serotonin transporter (SERT), our goal was to characterize the effects of blocking auxiliary ‘uptake 2’ transporters of serotonin on social and repetitive behaviors in mice. Organic cation (OCT) and plasma membrane monoamine (PMAT) transporters are among the uptake 2 transporters found in the brain. The alkaloid antibiotic berberine has antidepressant-like properties in mice, and is both a blocker and substrate of OCTs. Preliminary evidence using a compound, decynium-22 (D-22), which blocks OCT, has shown behavioral enhancing effects in socially impaired BTBR T+/tf mice. With this in mind, we hypothesized that berberine will have similar socially enhancing benefits in BTBR mice. In order to elucidate whether berberine may have effects on social behavior, we used BTBR males as a social control and C57BL/6 males as a socially impaired model. Mice were tested for social interaction and restrictive repetitive behavior using a 3-chamber apparatus and marble-burying test respectively. Indeed, berberine significantly increased BTBR preference for social interactions and social sniffing (p < 0.05, N=8-9). However, berberine had no impact on the typical sociable behavior of C57BL/6 mice, nor did it alter repetitive marble burying in either strain. Our findings confirm that systemic uptake 2 blockade is a promising strategy for improving social behavior, warranting further investigation as a treatment for sociability impairments. A study was conducted using the commonly used anti-diabetic drug metformin (150 mg/kg), an OCT3 inhibitor, where initial results indicate that it failed to enhance sociability in C57BL/6 mice. Future studies will examine the effects of metformin on the BTBR strain.

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Funding Source: CDMRP Autism Idea Award AR110109
Choice Neighborhood 2015 Impact Assessment

Aroosa Ajani* & Beth Legg*, Dr. Christine Drennon

The Choice Neighborhood 2015 Impact Assessment measures the impact of several strategies of the Eastside Choice Neighborhood implemented in 2015 on former Wheatley Courts residents and assesses their success. The timing of this impact assessment is situated in the relocation of Wheatley Courts residents and the rebuilding of a new housing development, East Meadows, which seems to ignite the real estate market and increase land speculation. Neighborhood surveys, crime data, real estate data, Urban Strategies case management data, and interviews inform the effectiveness of continued and newly implemented programs. Our team has gathered the various data sources to form an in-depth look at the impact of the relocation and revitalization on the movement of residents towards self-sufficiency, real estate market, social networks in the neighborhood, crime prevention through environmental design [CPTED], increase in the number of businesses, and the schools’ mobility ratings. With the relocation of 661 residents during the tear down of Wheatley Courts and building of the new East Meadows, to understand the impact of strategies implemented by Choice Neighborhood partners is crucial to better inform and assist the Eastside Choice Neighborhood in accomplishing future goals.

Funding Source: San Antonio Housing Authority
Upper Permian reefs evolution along the southern margin of the Yangtze Platform, Yungan and Guntianao, Guizhou Province, south China

Dongyang Liu* & Rui Guo*, Dr. Dan Lehrmann

The Nanpanjiang Basin of south China is a rapidly subsiding embayment in the southern margin of the Yangtze microcontinent that was located in the tropical eastern Tethys Sea during the Permian. The basin is bordered to the north by the Yangtze Platform, a vast shallow-marine carbonate shelf.

Upper Permian reef facies at Guntianao are massive boundstone with a primary framework of Inozoan and Sphinctozoan sponges bound by laminated microbial crusts (*Archaeolithoporella*) and marine cements. Additional frameworks are constructed by branching bryozoans. *Tubiphytes* encrusts frameworks and forms secondary framework. Organisms dwelling within the framework include foraminifers, fusulinids, brachiopods, bivalves, and dasycladacean algae. Upper Permian reef facies at Yungan are massive boundstone with a primary framework of Inozoan sponges and bryozoans with Rugose corals and Sphinctozoan sponges serving as secondary framebuilders. Dwelling organisms include foraminifers and dasycladacean algae.

The character of Upper Permian reefs changes dramatically from Guntianao to Yungan over a distance of only 20 km. Reefs at Guntianao are heavily bound by microbial encrustations (*Archaeolithoporella*) and marine cement, whereas reefs at Yungan lack these encrustations. Sponges at Guntianao are smaller (up to 1 cm diameter) whereas those at Yungan are larger (up to 5 cm in diameter). In both the Guntianao and Yungan areas we found no evidence of bioerosion (destroyer guild).

Despite the dramatic biotic turnover associated with the end-Permian extinction, the Upper Permian and Middle Triassic reefs of south China are very similar. Sponges are the dominant metazoan framebuilder in both. Both contain *Tubiphytes* frameworks, and both are heavily bound by microbial (*Archaeolithoporella*) and marine cement crusts. Even though these reef boundstones have a significant metazoan framework component, they also have a large (in some cases dominant) volume of microbial and abiotic (cement) precipitates. The large role of microbial and abiotic (cement) precipitates differs from modern skeletal metazoan reefs.

Funding Source: Shell International Exploration and Production, Saudi Aramco
Students + Startups Summer Internship: An Introduction to the Startup World

Nadia Lozano*, Dr. Luis Martinez

The Students+Startups Program was designed to connect Trinity students, regardless of major or academic background, to the local startup community. This match allowed students to learn from local entrepreneurs how they built their companies. Because startup companies are usually composed of small teams with large amounts of responsibilities, students in this program receive an immersive experience while performing meaningful work.

My position at Codeup required me to perform various assignments within the company. These assignments allowed me to play a significant role in the company while reaching my learning goals. At the beginning of the summer, I developed five specific learning goals: to understand how a career accelerator compares to a college education, to understand how a startup company is run, to gain an understanding of the skills needed to succeed in a startup company, to explore new career options in marketing and/ or management, and to learn how to perform different tasks outside of my required duties and field of expertise. The learning goals enabled me to choose which projects would best help me grow professionally. Furthermore, my learning goal helped me find a purpose in everything I was doing and then find a way in which to connect every task I was performing with a lesson.

Funding Source: 80/20 Foundation, Trinity University, and Codeup LLC
Students+Startups Codeup Internship

Emma MacEachern*, Dr. Kay Jones

The Students and Startups internship at Codeup provided me an in-depth look into the start-up world and grew my applied skills in the professional business world. I worked with the marketing team primarily, but also helped instructors, the operation management team, and student development department. My internship at Codeup gave me appreciation for the difficulty of maintaining a startup. Most importantly, I learned about the ethics of business and how to work with others in a professional setting, one of my goals during the program. Startups depend on a strong sense of teamwork and helping others out whenever possible. My work in the various departments of Codeup helped me learn this valuable skill.

Another one of my goals was increasing Codeup’s online presence. I accomplished this by creating a social media content calendar with scheduled posts, each with their own target audience and hashtags. I also designed one-page flyers with attention grabbing graphics. In addition, I began crafting blog posts surrounding important news, such as Demo Day and the acceptance of the GI bill, for their website.

My last goal for this internship was to improve my skills in graphic design and social media marketing. By designing advertisements in Canva and publishing social media posts, I discovered my own designer eye, finding a balance between text and graphics. Google and Facebook analytics enabled me to increase my proficiency in social media marketing. Using analytics gave me tangible statistics on how well my posts were doing by showing me their reach and response rates. I was able to determine which techniques to use for each post on each channel that directed the greatest audience to the Codeup website.

Interning at Codeup taught me invaluable skills that I will use in obtaining my dream career as a consultant or manager of an interior design, fashion, or culinary business.

Funding Source: 80/20 Foundation and Codeup
Robotic Chemotaxis Controller

Subrat Mahapatra*, Dr. Kevin Nickels & Dr. Hoa Nguyen

Finding the source of a chemical leak or an oil spill has become increasingly important, and learning to identify the source of the leak is a critical step in being able to control it. In certain dangerous environments however, traditional chemical sensors might be prone to error. In heavily drug trafficked areas, Patrol dogs might get fatigued or injured. Determining the source of leaks in a power plant would be useful in fixing the plant and prevent evacuation of the entire plant. This motivates the topic of chemotaxis which encompasses the movement to a chemical source by monitoring changes of chemical signals.

In the Nickels lab, there has been a need to develop a robotic controller that works as a state machine where sensory data allow us to decide on specific modes for a robot. Without any evidence of a leak, the robot patrols the area on a lookout. In the event that the robot encounters a significant concentration of a chemical, the robot would change states and attempt to figure out where the leak was coming from. This project extends a previous chemotaxis project where algorithms were designed to mimic biological organisms and to follow a plume to its chemical source.

This robotic controller leverages the Robotic Operating System (ROS) to help establish different nodes that communicate with the robot. Localization, or finding the current location of the robot, is important in understanding the robot’s relationship with the environment. Here, an external camera was trained to recognize the robot. The camera calibration tool was used in order to map the camera coordinate system into world coordinates which were then sent to the ROS master node so the robot’s location could be known. The ROS controller has access to all the information necessary to make informed decisions about which state the robot should be in, including the current location. The current robotic controller was implemented with four modes (Patrol, MoveToGoal, MoveToBase, and ChemoTaxis). This model allows for generality where one could use the controller on different robots in other analogous environments. One of the greatest strengths of this project is that one can develop different modes and simply link up the controller to the new mode. More advanced movements or actions after more research can easily be accommodated as a extension of the controller’s abilities.

Funding Source: Murchison Grant, Trinity University
Summer Accelerator:
Women Ambassadors Forum

Kelly Burke*, Meghan Mardashti*, Emma MacEachern, & Ingrid Harb, Dr. Luis Martinez

Women Ambassadors Forum is a worldwide organization led by students and young professionals. Our mission is to provide female leaders with a platform where the free flow of ideas, mentorship and entrepreneurial skills can give women the power to reach their full potential.

In June, 2016, WAF hosted a 5-day forum hosting 35 women, ages 18-30, from 10 different countries. During the forum they partook in peer-lead workshops where they: Developed “Stories of Self, Us, & Now”; learned different leadership models; learned coordination and recruitment activities; strategized timelines effectively achieving goals; and networked with women from around the world. They also had the opportunity of hearing our lineup of distinguished women speakers.

Through being involvement in the Summer Accelerator Program, WAF has been developing plans to become a sustainable non-profit within the next year. These plans include: brainstorming concepts for our app development, developing an efficient application process, and developing a schedule for the management team this fall. Other important activities include beginning the process of trademarking our name and logo, and increasing reach and engagement via social media.

Our poster will numerate the important growth statistics we’ve collected from our 2015-2016 as well as images and highlights from our distinguished speakers and women ambassadors who attended the 2016 forum.
Injecting Nanoscience into Advanced Laboratory Curriculum

Cameron Martin*, Dr. Jennifer Steele

Our goal is to insert exercises demonstrating techniques and phenomena unique to nanotechnology into Trinity’s Department Physics and Astronomy upper division laboratory courses. This poster will focus on two of these exercises.

In our first exercise explore surface plasmon resonance on nanoparticles. A surface plasmon is a quantized oscillation of conduction electrons on the surface of a metal. To fabricate the nanoparticles, we heated 5-15 nm thick layers of gold and silver on a microscope slide to form pancake shaped nanoparticles. As we heat the metal films the nanoparticles form, altering the color of the film. Although the effect may be observed by the naked eye, we employed a spectrometer to quantify the change in color. Since the wavelength of light at which surface plasmon resonance occurs is sensitive to the materials’ environments, we also varied their surrounding medium to induce a change in resonance wavelength. While the change in resonance was not as dramatic as we hoped, it was still able to be measured by spectroscopy and the experiment itself is still an easy to grasp demonstration of the optical effects of surface plasmon resonance.

In our second exercise we devised an experiment to explore surface plasmon excitation on a metal film. These films were created by using a sputter coater to deposit 50 nm of gold or silver onto microscope cover slides. The films were attached to a prism using index matching fluid so that we may excite surface plasmons using the Kretschmann configuration. A white light source was used to excite the surface plasmons. Because the surface plasmons excited on metal films are not localized as they are on nanoparticles, surface plasmons can be excited at a variety of wavelengths as a function of the incident angle of light. In this project we varied the angle of incidence of our light source to explore this relationship between angle and wavelength and compare our data to theory. We also explored the effects of varying the surrounding medium.

Funding Source: W.M. Keck Foundation
Trinity University’s Students+Startups internship is available to qualified students seeking hands-on experience with a local startup company. I was partnered with a local non-profit organization, SASTEMIC, which aims to promote STEM education throughout the San Antonio area. Because non-profits and startups are leaner than an established business, this internship has allowed me to engage skills I had begun cultivating in the past.

Engaging with SASTEMIC I was able to expand my media management and market research skills to produce tangible results; I made a difference in an organization while learning valuable skills that apply across fields related to my majors, human communication and entrepreneurship. My additional learning objectives are widely applicable: I learned about media organization, organizational communication, video editing, and became familiar with programs such as Hootsuite and Buffer for social media marketing calendars. Attaining these skills in addition to the valuable work experience has better prepared me for entering into the professional world.

Funding Source: SASTEMIC, and The 80/20 Foundation
As normal fault systems develop, they often form a segmented, en echelon pattern. As the system evolves, fault segments interact with each other through changes in the local stress field. These changes may cause subsidiary structures such as joints to form in a range of orientations, and these structures impact permeability and fluid flow connectivity. By investigating the connection between fault segment interaction and subsidiary structure formation, we gain a better understanding of similar systems in the subsurface.

We studied the Sevier fault zone near Orderville, Utah, to document subsidiary structures related to a right-step in the fault zone. The Sevier fault is one of the easternmost Basin and Range fault systems at the transition into the relatively stable Colorado Plateau to the east. We chose this location because it has excellent outcrop exposure, with a classic example of a breached relay ramp between the overlapping (>6000 m overlap) fault segments.

To investigate how the evolution of the Sevier fault segments affected the stress field and resulting subsidiary structures, we modeled the system using the Fault Response Module within the Move2016 suite, 3D computer modeling software. We created 3D models of an en echelon fault pair at different stages of overlap and with different magnitudes of normal dip-slip fault displacement. For each model, we evaluated spatial variations in vertical displacement, strain dilation, stress in the East-West and North-South directions, and coulomb stress state. Our model results reveal how the stress field around the fault transfer zone may have evolved over time creating the subsidiary structures we documented in field research. By analyzing these models, we found that changes in the stress field and the resulting joint pattern strongly depend on the magnitude of fault overlap. We also show that the magnitude of segment overlap impacts fracture dilation within the fault transfer zone, which has implications for the development of permeability in similar fault systems.

Funding Source: The Department of Geosciences’ Edward C. Roy fund for student activities and research
SA Students + Startups: Jungle Disk

Philip McKeon*, Dr. Erin Hood

The Students+Startups Summer Internship program is designed for students in the sciences and humanities to gain valuable business experience by working alongside startup tech entrepreneurs. By applying myself to real world tasks, I have been able to hone my skills in a meaningful way in the business realm. My internship this summer was with Jungle Disk, a ten year old company that sells data security through its encrypted backup software and its network threat protection product. Working with Jungle Disk has allowed me to contribute to the company while learning how to conduct myself in a professional setting.

My internship with Jungle Disk required me to work diligently on myriad projects aiming to increase Jungle Disk’s marginal sales and raise market penetration in the San Antonio area. This internship offered me the opportunity to learn, work, and network, and is an experience I will not soon forget. To help focus my endeavors, I created four learning objectives designed to help me stay on track and perform to the best of my ability. These goals included learning to use new computer programs, designing marketing materials, plan seminars, and make sales pitches. This poster will highlight and explain my learning goals, discuss the various projects that helped me achieve these goals, and explain the results of my internship experience.

Funding Source: Jungle Disk, LLC and The 80/20 Foundation
The Arts, Letters, and Enterprise (ALE) program at Trinity is designed to further develop students' critical thinking, writing, public speaking, leadership, and business literacy skills by building on the liberal arts roots of Trinity. By providing a summer internship in a professional atmosphere, the ALE program has allowed me to use my critical thinking skills as a Mathematics major and ALE minor in an interesting and unique environment only available through this real-world working experience.

As an intern for the President and Executive Director of ARTS San Antonio, I was tasked with a plethora of engaging and diverse projects that frequently placed me outside of my comfort zone. Whether it be contract management and administration, ticket sales analysis and predictions, performing artist research, or precise writing to highlight the successes of the organization’s arts education program, my time at ARTS San Antonio has helped me strengthen my communication and business skills in a tremendous way. This poster will highlight these key projects and the eye-opening lessons learned along the way.

Funding Source: Arts, Letters, and Enterprise Minor
The Country Club Collection

Danny Oh*, Dr. Luis Martinez.

The Country Club Collection is a startup company that consists of a country club consulting entity and an ecommerce platform that liquidates exclusive premium apparel and tour issue gear, making it affordable and available for everyone. We help country club pro shops become more financially stable and easier to manage while providing our ecommerce customers access to exclusive apparel, which is not available to the public at an affordable price.

This summer has been an incredible growth period for the startup. What use to be a project and hobby is now an incorporated limited liability company thanks to the Trinity University Entrepreneurship Department and Stumberg Grant. We have a continuing increase in sales along with a viable business plan to scale the business. There are plans to bring in four new employees in the next two months so that operations can be delegated and functioning optimally.

Through the summer program I have spent time attending meetings at Geekdom with successful CEO’s and entrepreneurs, startup pitches at One Million Cups at Café Commerce, weekly roundtable discussions with the other Stumberg Finalists, mentorship meetings with Dr. Martinez, and have been exposed to the vast networking opportunities of San Antonio, like Techbloc. This summer program has shown me the great opportunities there are in the City of San Antonio. I am ready to build my company here for the long term.

Funding Source: Stumberg Prize, Trinity Entrepreneurship
The Rape Crisis Center of San Antonio: Combating Sexual Violence

Sarah Parrish*, Dr. Aaron Navarro

In the United States, 1 in 6 women and 1 in 33 men will be the victims of an attempted or completed rape. Of all sexual assault victims, almost half are under the age of 18. As a result of such violence, a group of people founded the Rape Crisis Center (RCC) of San Antonio in 1975 in order to combat sexual assault occurrences and care for those affected by sexual violence in our community. The RCC implements: crisis intervention techniques, including hospital advocacy and 24/7 confidential hotline support; prevention education; and provides free and confidential counseling for clients. As a way of getting involved and serving the people of San Antonio and surrounding communities, I went through extensive training that explicitly defined sexual assault and its effects on people, how to assist survivors, and what resources to give them, all in order to become a hospital advocate. By recruiting volunteers to serve in crisis intervention, the RCC hopes to promote awareness of sexual violence, educate people on what constitutes sexual assault, and care for those affected by it. In doing so, the RCC helps to improve the quality of lives of those affected and decrease the quantity of occurrences of violence in our community.

Funding Source: MAS: Mexico, the Americas, and Spain
Mudrock geochemistry of the Ochoco basin, central Oregon: Testing models of post-Cretaceous terrane translation

Mollie Patzke*, Isaac Johnson*, & Thomas Tremain*, Dr. Kathleen Surpless

The North American Cordillera has a well-studied tectonic history of terrane accretion and translation, but the magnitude of coast-parallel translation since Cretaceous time remains uncertain. Various tectonic models predict moderate (<1000 km) or large-scale (>1000 km) terrane displacement since ~100 million years ago. Because the Ochoco basin of present-day central Oregon was deposited unconformably on the Blue Mountains terranes during the Cretaceous Period, characterizing the provenance of the Ochoco basin may better constrain translation magnitude proposed by these models. For example, moderate displacement models suggest a combined Cretaceous Hornbrook-Ochoco Basin, while large-scale displacement models juxtapose the Ochoco basin with the San Joaquin basin of the southern Great Valley Group in California.

We analyzed 28 mudrock samples from the Mitchell Inlier, a submarine fan deposit within the Ochoco basin, using X-ray fluorescence and inductively-coupled plasma mass spectrometry at Washington State University. Geochemical results indicate an active magmatic arc source throughout deposition. Although samples show some variability, the absence of systematic changes with stratigraphic position suggests that sediment sources did not change significantly through time. Weathering trends derived from major-element compositions of Mitchell Inlier mudrocks suggest granodiorite and andesite source rocks. Rare-earth element (REE) plots consistently show a slight negative europium anomaly as well as light REE enrichment and near-flat heavy REE patterns, all typical of sediment derived from active margin settings. Trace-element data indicate that magmatic processes controlled source composition, rather than sedimentary recycling. Initial epsilon Nd values range from -6 to +2, indicating that sediment originated from both juvenile and evolved sources.

Our Ochoco basin geochemical results are consistent with mudrock geochemistry of the Hornbrook Basin, suggesting that these two basins shared similar sources. In contrast, Ochoco results do not overlap significantly with geochemistry of the southern Great Valley Group. Therefore, our Ochoco mudrock geochemistry results support moderate-translation tectonic reconstructions that posit a combined Cretaceous Hornbrook-Ochoco basin.

Funding Source: National Science Foundation
Neuromuscular Junction, What’s Your Function? Does NMJ Size Influence Lizard Behavior?

Amy A. Payne*, Xiuzhi (Henry) Wang*, & Adam J. Zeb, Dr. Michele A. Johnson

Neuromuscular junctions (NMJs) are the area of connection between a neuron and a muscle cell, where a chemical called a neurotransmitter is ejected from the neuron toward the muscle cell. When the muscle detects the neurotransmitter, it contracts; thus, NMJs are critical for all behavior. But, do they vary in size if behavior varies? During the breeding season, male Anolis lizards frequently use two muscles, the Ceratohyoid (CH) and Retractor Penis Magnus (RPM), which are responsible for two important behaviors respectively: the display of the dewlap at its throat, a structure used to attract females, and movement of the hemipenes, (reproductive organs) during copulation. Yet Anolis species vary dramatically in the frequency of dewlap displays and copulation. To understand why these species vary in reproductive behaviors, we analyze the size of NMJs in the CH and RPM muscles across 10 Anolis species from the Dominican Republic. Previously, we collected behavioral data on the frequency of copulation and dewlap extension for each of these 10 species in the Dominican Republic. Here, we test the hypothesis that species that display and copulate more frequently have evolved larger NMJs in the muscles that produce those behaviors. To this end, we dissected the CH and RPM muscles from frozen tissues and stained the muscles for acetylcholinesterase, an enzyme that breaks down the neurotransmitter acetylcholine, and is only found in the NMJ. Further, we compare NMJ size in anole lizards to variation in NMJ size across animals, as reported in the primary literature. This study is the first of its kind to use a comparative approach to analyze NMJ size across species.

Funding source: National Science Foundation IOS 1257021 to M. A. Johnson, Texas Ecolab
Policy over Politics: A Summer in City Government

Alexander Perkowski*, Dr. Jacob Tingle

The Arts, Letters, and Enterprise Summer Internship program serves to establish a nexus between Trinity students and the surrounding San Antonio community through student work. Students in the program are able to apply their Trinity education to their position.

My position at the Mayor’s Office of San Antonio strengthened my existing skills and taught me how a nonpartisan city government runs. Over the course of the summer, I engaged in such activities as research, writing, attending council meetings, and press conferences and events. At the beginning of the summer, my faculty advisor and I developed four learning objectives: writing skills, information gathering, teamwork, and networking. Over the course of the internship, these objectives were reinforced by my tasks. This poster will highlight some of the projects I worked on this summer. These projects include various public safety memos, an Interfaith event, and other experiences, in addition to highlighting my progress over the summer in meeting my learning objectives.

Funding Source: ALE Minor
“Can You Zav It?”: Testing children’s verb learning across memory delays.

Blaire Porter*, Andrea Lee*, Claudia Garcia, Shea Voss, Nick Thies, Carl Warren, & Victoria Ramos, Dr. Jane Childers

Verb acquisition requires children to segment dynamic scenes and link particular elements to specific verbs. Cross-situational information can help children deduce which elements link to which verb (e.g., Scott & Fisher, 2012; Childers & Paik, 2009). One theory of cross-situational learning, Structural Alignment theory (e.g., Gentner, 1983; 1989), predicts that children will benefit from seeing related events that are highly alignable as opposed to low in alignability. In high alignable events, the number of objects, their shape, and the roles the objects play in events are similar across examples; in low alignable events, these aspects differ. Children learning verbs in everyday environments also hear a specific verb over time, so need to compare events across delays, thus we also are manipulating delay by presenting events across a 1 minute or 3 minute delay. We predict that older children may perform better than younger ones when experiencing the longer delay. We also predict that children in Study 1 who see high alignable events may perform better than will children in Study 2, who will see low alignable events.

In Study 1, two ½- and 3 ½-year-old children (n = 50 for each age group planned) are randomly assigned to a No Delay, 1 minute Delay or 3 minute Delay condition; all children see High Alignable comparison events. In all conditions, children learn two novel verbs. For each verb, children first are given a warm-up trial with access to the test objects. They then see 3 sets of comparison events. In each set, 3 different learning trials are presented. In a learning trial, the experimenter uses familiar objects to enact a distractor event (e.g., walk the dog) and then a relevant event (e.g., attach a fish to a board). S/he then reads a book to the child for 1 or 3 minutes, then presents a second learning trial. This is repeated until the experimenter presents 3 trials, then the test phase begins. At test, children are given new objects to enact the event in two test trials.

A univariate ANOVA will be computed with Age (2: 2 ½, 3 ½ years) and Delay (3: none, 1 minute, 3 minute) as between-subjects factors, and the mean proportion of verb extensions at test as the dv. Based on prior research, we predict a main effect of Age and a main effect of Delay. These may also interact with older children performing better in the 3 minute delay condition than younger children. One limitation of this research is that it will be difficult to separate cognitive abilities (e.g., attention span) from linguistic abilities (e.g., better verb learning skills) in these results; likely both will contribute. This research is important as few studies have examined verb learning over delays.

Funding Source: Trinity University Psychology Department, Mach Foundation
Preliminary Characterization of Secondary Metabolites from the WS5995-Producer *Streptomyces acidiscabies* 84.104

**Ryan Pu**, Dr. Frank Healy

*Streptomyces* bacteria are morphologically complex and produce different classes of secondary metabolites, for example polyketides and peptides, with a broad spectrum of biological activities, including anticancer, antibacterial and other drugs. It is of interest to understand the assembly of these compounds for a variety of reasons. For example, to aid in the improvement of existing drugs or in the design and synthesis of novel drugs. *Streptomyces acidiscabies* produces the WS5995 aromatic type II polyketides which, while simple angucyclinones, undergo an uncommon oxidative ring cleavage reaction during assembly. Analysis of the organism’s ~11 Mbp genome reveals numerous types of secondary metabolite biosynthetic gene clusters, including one predicted to encode polyketide synthase (PKS) enzymes for the production of type II aromatic polyketide(s). In this study, we report findings from the preliminary analysis of metabolite extracts of wild type *S. acidiscabies* cultures, and derivatives carrying type II PKS pathway and regulatory mutations in order to characterize products and intermediates associated with the gene cluster. Ethyl acetate extracts from culture filtrates of wild type, and flavoenzyme, luciferase and GBL receptor homolog mutants were analyzed using silica gel thin layer chromatography and reverse phase HPLC. Chromatogram data reveal differences in metabolite abundances and profiles between wild type and mutant extracts. A non-polar compound present in high abundance in GBL receptor mutant extracts was purified and analyzed by proton NMR spectroscopy. NMR spectral data were consistent with the compound possessing some structural characteristics of polyketides such as the WS5995 aromatic polyketides, but of insufficient quality to make precise structural assignments. Future efforts will focus on a systematic genetic and biochemical characterization of the pathway and structural elucidation of intermediates and products, and determining whether the pathway encodes components required for WS5995 biosynthesis. If so, our analysis should provide insights into the mechanism underlying the ring cleavage of the WS5995 metabolites.

**Funding Source:** Murchison Research Fellowships
Using Theatre Training Techniques to Change Society

Jacob Pursell*, Dr. Roberto Prestigiacomo

There are some theatre artists that are pioneers to their craft. These pioneers not only add to the craft of theatre and performance but through their art, they also contribute to society and its betterment. Eugenio Barba and Augusto Boal are two of these theatrical pioneers. Barba uses strenuous training in order to undo the muscle structure of his actors, enabling them to build a physicality of any character. Boal used performance to address social oppressions by actively involving the individuals affected by the oppression in the scene. Jacob’s research brings the two together, by applying Barba’s training techniques to Boal’s social change performances. By doing this training, Boal’s work becomes more specific, authentic, and personal to the actors and to the spectators.

Funding Source: Mellon Initiative
Robotic Visual Localization

Nathan Richter*, Dr. Kevin Nickels & Dr. Hoa Nguyen

Localization, or tracking the position of a robot in the world as it moves, is an unsolved problem in robotics, especially in indoor navigation. Various methods have been applied to locate robots in the indoors, including matching LIDAR scans with maps, monitoring WIFI access port strengths, and even monitoring the robot with security cameras. While these methods have their benefits, they can be tricky to implement. This project developed a process using an upward looking camera to compare images of the ceiling with pre-mapped images, tracking its location. The use of moving cameras to track the location of a robot is referred to as visual odometry. We were inspired by a similar approach at Southwest Research Institute where the location of an autonomous vehicle was tracked using a downward looking camera and pavement images.

In this research project, a database of registered images of the ceiling was constructed. Each of these images was tagged with the 2D position of the camera. This database was queried to compute a moving camera’s location by finding, extracting and matching important features in the database image to the most current image, yielding precise locations for the camera.

Specifically, this project used the Computer Vision and Image Processing toolboxes of Matlab. The Matlab script used to produce this position compared each database image with a current image. Using the Features from Accelerated Segment Test (FAST), Binary Robust Invariant Scalable Keypoints (BRISK) and Speeded-Up Robust Features (SURF) feature detectors, potential features were found and matched in the database and current images. The feature locations were converted from pixel coordinates to world coordinates using a calibrated model of the camera. A 2D affine transformation was calculated, modeling the relative camera motion between the database image and the current image. Finally, the absolute location of the current image was computed by composing the location of the database image with the relative translation. This process was repeated for each of the four database images closest to the predicted position of the camera.

In its final test the locations corresponding to a series of photos taken by the camera were calculated as it moved. The script calculated the unknown positions, effectively implementing visual odometry to recover the path of the camera from images. This technique proved to be quite effective, with the script calculating the camera’s positions within a centimeter on average. This is a vast improvement over normal odometry data which only calculates relative position and is nowhere near the precision offered by this visual odometry method. This algorithm will become a ROS (Robot Operating System) node, working with other navigation nodes to better calculate a robot’s pose in space by using the camera.
Self-directed, mirror-mediated cognitive behavior in wild long-tailed macaques (Macaca fascicularis)

Ryan Reusch* & Anna Rigodanzo*, Dr. Kimberley Phillips

Our study will examine the extent to which wild long-tailed macaques (Macaca fascicularis) interact with mirrors, in order to determine their capacity for self-awareness. The literature indicates that there are generally two behavioral responses that an animal will exhibit during mirror exposure. The animals will either identify themselves in the mirror, indicated by self-directed behaviors, or perceive the reflection as a conspecific and react aggressively or submissively. Previous research suggests that self-directed mirror use is indicative of self-awareness, thus opening the possibility that the animal may have the ability to experience sympathy and empathy. These characteristics could provide insight into animal social behavior. The experiment will be conducted on a free-ranging, habituated population of approximately 25 long-tailed macaques on Tinjil Island, Indonesia in August 2016. Observational data will be collected through opportunistic sampling as the macaques approach the mirror. In order to provide another measure of mirror use, a laser pointer will be used to “mark” each animal as they investigate the mirror. The laser will be focused on a part of the macaque’s body that the macaque can not see without the mirror. Thus any substantial investigation of the mark relies on the fact that the macaque knows how to use the mirror. We hypothesize that the macaques will have a greater number of self-directed behaviors than conspecific responses. In addition, we hypothesize that the ratio of self-directed to conspecific behaviors will increase with the addition of the laser pointer “mark.”

Funding Source: Murchison Summer Research Fellowship and the Mind Science Foundation
Modulating Human β-amyloid Aggregation

Yara Samman*, Thomas Oster, & Raghad Akrouk, Dr. Saber Elaydi & Dr. James Roberts

Alzheimer’s disease is one of the most prevalent neurodegenerative diseases in the elderly. The aggregation of the protein beta amyloid is believed to be integral to the pathology of Alzheimer’s disease. We are investigating β-amyloid aggregation at different times with the goal of figuring out the rate constants for the different aggregation reactions. We are working with a mathematical model to represent that aggregation to then use to find the activation energy. β-amyloid 1-40 and 1-42 were incubated at 37°C for different amounts of time. After incubation, the samples were crosslinked by linking the nucleophilic amino acids by adding Ru(bpy)3 and irradiating it with direct white light for different periods of time. The cross-linked peptides were then electrophoresed on SDS-polyacrylamide gels. We wanted a protein stain with high sensitivity to minimize the amount of expensive β-amyloid; thus we tried Silver staining, Sypro Ruby and a stain free gel (Biorad Inc.) that fluoresces under UV light. Sypro Ruby yielded the optimal resolution. Our studies showed that optimal time for irradiation was 60 seconds with aggregation visible at 24 hrs and increasing till 72 hrs incubation for βA 1-42 and 7 days for the 1-40 βA. Because β-amyloid is very expensive, we collaborated with microbiologist Dr. Frank Healy to genetically engineer E.coli bacteria to produce human β-amyloid 1-42. We designed the segment of DNA (Fisher Scientific) and PCR was used to replicate the β-amyloid DNA and was then inserted to an expression plasmid with an ampicillin resistant gene. After the Amp® colonies were grown, we tested for β-amyloid presence by SDS-PAGE stained with coomassie blue and identified several positive colonies to further characterize. We are currently determining how to modulate the rate of β-amyloid aggregation by altering temperature or adding purified HDLs and LDLs from astrocytes.
Encouraging Student/Faculty Relationships in Educator Preparations

Anthony Sanchez *, Dr. Heather Haynes Smith

Learning Express-Ways were developed and researched at The University of Kansas Center for Research on Learning (KUCRL) to foster the development of positive academic relationships with students and allow students, especially those with disabilities, to communicate with a teacher and express learning-related interests and needs. Using Learning Express-Ways alongside Strategic Instruction Model (SIM) Learning Strategies and Content Enhancement Routines (Comprehensive, evidence-base teaching programs), classroom teachers can use Learning Express-Ways to connect with individual students, in both general and special education, to achieve benefits including: a place to record student concerns, improved, cueing feedback to address specific student concerns, documenting progress monitoring and changes in instruction, and building trust and a positive relationship.

This research uses grounded theory to examine the Learning Express-Ways’ ability to create, if any, student-teacher relationships at a post-secondary level. Express-Ways feedback forms were modify from the original model to adjust for a college level class and then given to three professors teaching the same special education course. These forms were gathered at the end of the year with the responses of the students. The responses were transcribed, coded, and interpreted to create our findings.

Funding Source: Trinity University’s Ronald E. McNair Post baccalaureate Achievement Program
Empowering the Passive: Implications of Increasing NGOs and their Impact on North Korean Refugee Resettlement in South Korea

Sabrina Sha* and Elena Wilson*, Dr. HJ Yoo

Our research focuses on the role South Korean governmental and non-governmental networks play in socializing North Koreans living in South Korea. Without proper experience of capitalist and democratic systems, the defectors experience a number of difficulties in adapting to the new society with respect to finding jobs, securing housing, getting education, and learning a new culture. The increase of North Korean defectors living in South Korea since the early 1990s has demanded a variety of organizations to be involved in the process of facilitating assimilation. While the South Korean central government provides initial institutional support, local governments and non-governmental organizations (NGOs) comprise much of support system that participates in helping these defectors resettle.

We will examine the present complex network of government and NGO programs, as well as the discrepancies between them regarding the types of programs offered, budget allocations, and underlying political motivations and goals. We will evaluate the support programs offered to these North Koreans, identifying the fundamental differences not only between the two network groups, but within each group itself. Using archival research, empirical studies, and interviews, our research addresses three critical components: 1) the link between the government and NGOs, 2) the interaction amongst various NGO groups, and 3) the efficacy of governmental policies geared towards resettlement. This study explains how such marked discrepancies affect the success of resettlement policies and programs and what these programs ultimately mean for North Koreans living in South Korea.

Funding Source: Murchison Fellowship and Mellon Summer Undergraduate Research Fellowship (SURF)
The evolution of subsidiary fracture networks in segmented normal fault systems

Samuel Simoneau*, Dr. Benjamin Surpless

Normal faults commonly form segmented, en echelon patterns in map view. As normal fault segments propagate and overlap, the local stress field changes, so fracture orientations may change over time as the stress state in the fault transfer zone between segments evolves. Analysis of fracture networks can help us understand the evolution of segmented fault systems and help us predict the formation and propagation of fracture networks in the subsurface. Because fractures commonly increase permeability, the results of our work will inform our understanding of fluid flow at segment boundaries, impacting our relative access to natural resources such as water, oil, and natural gas.

The Sevier fault zone lies in the transition zone between the Basin and Range province and the stable Colorado Plateau. It is an excellent example of a segmented fault system with overlapping segments and well-developed joint networks. The well-studied fault zone strikes north-northeast, dips west, and has excellent outcrop exposure in Southern Utah, near the town of Orderville. We focused on two major, right-stepping fault segments that overlap by approximately 6 km, with strain also accommodated by two additional minor faults. In the field, we documented fracture orientation and spacing in the Navajo sandstone, and we annotated field photos to reveal relationships between joint sets. We compiled all data in a GIS database.

Our results show a dominant, steeply dipping, NNE-striking fracture system with an abrupt 25 degree clockwise rotation in the strike of fractures across the easternmost major normal fault. Fracture orientation is less systematic east of this major fault. This change in orientation is consistent with changes in the stress field caused by a propagating en echelon system. Our analysis of fracture spacing revealed significant outcrop-scale variability, but we documented no direct relationship between changes in joint intensity relative to distance from mapped faults. Our results suggest that while fracture orientations associated with a segment boundary are predictable, the relative intensities of fractures are not.

Funding Source: Ed Roy Fund
Play Your Way to Mental Wellness: An Exercise in Game Design and Working at a Startup

Woodrow Sims*, Dr. Cynthia Phelps & Dr. Erin Hood

The Students+Startups internship program was made to connect Trinity University students to the fast-growing world of local startups. By immersing myself in the world of these small, agile, businesses I was able to gain experience, not only as a software developer delivering a complete product to a client, but also gain knowledge and valuable insight to starting and running a small business.

Working with InnerAlly, my job was to help design and build a prototype game for mobile platforms which aims to help users practice self-compassion, a technique which has been shown to help people cope with a variety of issues, including depression, anxiety, and addictive behaviors. This prototype is to serve as a proof of concept to show potential investors, as well as a beginning point for developing a more complete app to put on the market.

While working at InnerAlly, I developed three specific learning objectives to help guide me through the process. Though these goals vary in their focus, from practicing good code form and legibility to professional skills, they all fall under the umbrella of necessary skills for creating and running a startup. This poster should give some insight into the production of this application, as well as highlight these goals and how I went about achieving them.

Funding Source: 80/20 Foundation, InnerAlly
ALE Summer Internship: Interning at the World-class Tobin Center

Samuel Steup*, Dr. Erin Hood

The Arts, Letters, and Enterprise (ALE) Summer Internship program is designed for students in the sciences and humanities seeking to develop their business acumen while performing meaningful work with a local business or nonprofit organization. By working backstage on a wide variety of shows, I was able to supplement the knowledge of theatre I have acquired through campus theatre work, and gained valuable experience working in a professional environment.

My position with the Tobin Center for the Performing Arts allowed me the opportunity to work on a wide variety of shows, including rock concerts, symphony recitals, comedians, parties, and professional galas. At the beginning of my internship, I developed four specific learning objectives for what I wanted to learn while at the Tobin Center. These goals allowed me to work with my supervisor to tailor the internship to my needs and interests, and to derive as much as possible from my experience as an intern. My main objectives for this internship were to develop a better and more comprehensive understanding of what goes into a production, foster positive working relationships with the Tobin Center employees, and to determine whether pursuing a career in professional theatre was viable for me. My poster will detail these learning objectives, describe some of the projects on which I had the opportunity to work, and detail how each project brought me closer to my goals.

Funding Source: Arts, Letters, and Enterprise Program
Analyzing Remote Utility Meter Diagnostics on a Mesh Network to Increase Power Grid Efficiency

Nicholas Swanson*, Dr. Larry Palmer

Certain utility companies have invested in upgrading their power grid by introducing Smart Meters. These meters have wireless capability and send power quality and diagnostic data directly to the Utility at regular intervals. This data can then be used to assess issues on the grid and at customer end points.

The raw data imported from the meters can be difficult to read and understand, and larger issues on the grid cannot be easily diagnosed. Data mining, data visualization, and the statistical software “R” are used to explore the issues that occur at each meter over time and the clustering of events on the distribution system.

In this set of experiments, real-time power quality data from a Utility is used to remotely explore possible issues on a city power grid. Tableau is used to combine location, power quality, and diagnostic data to better visualize the data. A Kohonen algorithm is implemented in R to cluster and connect different diagnostics to explore the correlation and possible common cause for multiple diagnostics.

Funding Source: Silver Spring Networks
Effects of 3-D Microenvironment and Mechanical Properties on the Neuronal Phenotype of HT22 Cells

Rachel Tchen*, Rodrigo Zurita, & Zach Nickle, Dr. Andrea Carolina Jimenez-Vergara & Dr. Dany J. Munoz-Pinto

Matrix stiffness and changes in cell microenvironment from 2D to 3D contexts are shown to be powerful factors modulating cell behavior. Although these two factors have been extensively investigated on mesoderm descending lineages, their effects on nerve cells are not fully understood. In this work, we built bioinspired microenvironments with variable stiffness to support the growth and phenotype expression of neuron-like cells in 2D and 3D contexts. Toward this end, the cholinergic neural cell line, HT22, was used as a cell model. An interpenetrating network (IPN) biomaterial comprised of type I collagen and Poly(ethylene glycol) diacrylate (PEGDA) of 3.4kDa and 6.0 kDa. The PEGDA at different molecular weights and concentrations provided the versatility to control the mechanical stiffness to achieve an elastic modulus of about 1kPa, which is close to native brain tissue.1

For encapsulated cells, we measured circularity within the IPN as well as cell viability 48 hours following encapsulation. Furthermore, we evaluated phenotypic changes of the HT22 cells between 2D and 3D microenvironments using two different moduli by quantifying gene expression levels. The genes assessed included general neural markers (β III Tubulin, Microtubule Associated Protein 2, Neuronal PAS Domain Protein 4, and Neural Cell Adhesion Molecule 1) as well as markers specific to cholinergic neurons (Vesicular Acetylcholine Transporter and Cholinergic Muscarinic Receptor 2). With this work, we aim to develop a primary in vitro 3D model that can be used in the study of neurological disorders such as Alzheimer’s disease.


Funding Sources: Murchison Summer Undergraduate Research Fellowship, Department of Engineering Science
Students + Startups Summer Internship: Marketing Strategy and Business Development with SnackDot

Annalisa Trevino*, Dr. Erin Hood.

The Students + Startups Summer Internship program is designed for students of all majors looking to develop and gain a better understanding of various business operations, by performing rewarding and challenging work with a local San Antonio startup. I utilized the research and analytical skills I have learned as an International Studies major to successfully complete different projects I was tasked with.

My position with SnackDot required me to complete an array of marketing and sales related assignments: aiding in the creation of a marketing strategy, blog writing, creating a social media calendar for 3 separate platforms, conducting sales calls, and distributing marketing materials. By developing 4 specific learning objectives at the start of the summer, I was able to ensure every project I was tasked with was completed in such a way that was in-line with my own personal goals. In doing this, I was also able to better see the true value of the work that I was doing for SnackDot. This poster will focus on two of these four learning objectives - in the marketing strategy development and business development - and the related projects that played a role in achieving my goals for the summer.

Funding Source: 80/20 Foundation and SnackDot
ALE Summer Internship: Using Technology to Save Lives

Calvin Usiri*, Dr. Gene Carangal

The Students + Startups Summer Internship program is designed for students in the sciences and humanities seeking to develop their business acumen while performing meaningful work with a local business or nonprofit organization. By engaging in realworld projects, I was able to supplement the analytical and technical programming skills I have acquired as an Economics and Computer Science major with the applied experience needed to excel in the professional world.

My position with Stratmedical required me to complete a wide range of assignments using frameworks such as Laraval and Bootstrap. There was an incredibly steep learning curve and every single day I had to study the language documentation because there was so much to learn and digest. I developed five specific learning objectives at the beginning of the summer, which guided my decision-making as I completed my projects. These learning objectives enabled me to not only better understand the value of the work I completed during the internship but also to articulate what I learned. This poster highlights five key learning objectives which are: to learn how to use Git for version control and working in a team environment, to develop functional knowledge of a Model-View-Control framework such as Laravel, to learn how to implement Bootstrap classes in order to make front-end changes to our application, to learn how to work in an Agile development team and to learn how to create automated unit tests and detailed testing plans.

Funding Source: Students + Startups, and Stratmedical
Investigating the Effectiveness of Novel Antifungal Agents Using Murine Models of Invasive Pulmonary Aspergillosis and Candidiasis

Cristian Vargas1,3* & Maximo Guerreri2,3, Rosie Jaramillo3,4, Marcos Olivo3, Laura K Najvar3,4, Dr. Nathan P. Wiederhold3 & Dr. Thomas F. Patterson3,4

This study was conducted to test novel drug therapies for two common fungal infections, Aspergillus fumigatus and Candida albicans, the former being particularly important for immunocompromised patients. Pulmonary aspergillosis is a major cause of morbidity and mortality in neutropenic and critically ill patients. Although many drugs already exist to treat the infection, their toxicity, interactions with other drugs, and limited effectiveness all hamper their usefulness. Additionally, emergent strains of Aspergillus fumigatus show increasing resistance to the azole-class of antifungal treatments due to prolonged exposure to the antifungals in patients with chronic pulmonary aspergillosis and environmental use in agriculture to protect against molds. Invasive candidiasis remains one of the most common nosocomial bloodstream infections and boasts significant morbidity and mortality rates. Pre-existing drugs used to treat candidiasis suffer the same drawbacks as the drugs that exist for aspergillosis. Thus, the need for novel therapies is evident, and this study evaluates the effectiveness of different experimental anti-fungal agents in an in vivo mouse model.

Using Aspergillus fumigatus clinical isolate Af293, male imprinting control region (ICR) mice were infected via aerosol inoculation inside an acrylic inhalation chamber. Prior to inoculation, the animals were immunosuppressed using cyclophosphamide and cortisone acetate and given enrofloxacin in their drinking water to prevent bacterial infection. Anti-fungal therapy began 24 hours post-inoculation, and the experimental drug was administered subcutaneously in varying concentrations to different groups of ten mice, with posaconazole acting as a positive control. Mice that became moribund were humanely euthanized, and lungs were harvested, weighed, and homogenized following euthanization. The homogenate was plated on potato dextrose agar plates and incubated to determine the fungal burden. Differences between the groups in terms of fungal burden as measured by colony-formation units per gram (CFU/g) are assessed for statistical significance. The candidiasis study was designed to evaluate the in vivo effectiveness of a novel drug therapy that targets the inhibitor of apoptosis proteins in the fungus, and compare it to the effectiveness of caspofungin, a drug currently in use. A Candida albicans isolate was injected intravenously with the number of cells adjusted to the average body weight of the ICR mice. Groups of mice received varying doses of the experimental compound—one group received the echinocandin caspofungin as a positive control and another group received a placebo. Kidneys and plasma were harvested to determine the fungal burden and to evaluate whether or not the novel drug is significantly more effective than caspofungin.

1Trinity University, 2Davidson College, 3The University of Texas Health Science Center at San Antonio, and 4South Texas Veterans Healthcare System, San Antonio, TX, USA
Accuracy and Performance Comparisons between several Sequence Alignment Algorithms

Jorgen Viltoft*, Dr. Matthew Hibbs

Over the past decades, multiple technologies have been developed to sequence DNA efficiently and inexpensively, leading to a large growth in the amount of available genomic data. However, in order to interpret these data, researchers must frequently align short DNA sequences to a much longer database of sequences. Many different computational tools have become available to the public that are able to align short sequences to a larger database in a reasonable time. Although these tools are typically well explained, it is difficult for those unfamiliar with the tools to assess which would be most beneficial for their work. A tool may be preferable due to its accuracy or efficiency, but without proper testing it may be challenging to decide between sequence alignment algorithms. The intent of this project is to consider some of the available tools, and compare them in terms of accuracy, speed, and flexibility. In order to accomplish this, a separate program was created in order to fabricate synthetic sequence data containing varying degrees of single nucleotide polymorphisms (SNPs), insertions, and deletions. These same sets of data were used with a variety of aligners for testing, and their results were recorded for comparison. The specific aligners tested were: Bowtie2, STAR, SOAP2, and GEM. By utilizing synthetic data, our evaluation program could compare the results of the selected algorithms to quantify their respective accuracies. Our results demonstrate that different alignment methods exhibit tradeoffs in terms of tolerance of mutations, run times, and application domains.

Funding Source: Trinity University
The influence of sterilization on germination rates among six *Asclepias* species

Xiaomao Wang*, Olivia Roybal, Lavanya Hospeti, Molly Lenihan, Kelly Lyons

In December 2015, San Antonio was named the first Monarch Butterfly Champion City. Over the last few years, and even more intensively in the wake of this recognition, is a growing interest in methods that improve monarch butterfly habitat along the species migration corridor from Central Mexico to Canada. Of critical concern are plant species used by monarch butterflies as larval and nectar resources along their spring and fall migration routes. Milkweed species (*Asclepias* spp. (Asclepiadaceae) are of critical importance to the monarch butterfly as the sole source of nourishment for the species’ larvae (caterpillars). Native milkweed species grown in a pesticide-free environment are therefore in high demand; however, due to the difficulty of growing the species and their slow growth rates, the supply is not meeting demand. We have dedicated a series of studies designed to elucidate best-growing practices for multiple species of milkweed that are native, in high demand, and are putatively preferred by monarch butterflies as larval resources. In this study, we aim to ascertain whether sterilization of seeds of several milkweed species prior to imbibing increases their germination rates and decreases the probability of pathogen colonization. We focus on the following species: *Asclepias speciosa*, *Asclepias tuberosa*, *Asclepias syriaca*, *Asclepias viridis*, *Asclepias incarnata* and *Asclepias asperula*. Our experiment is a 6 x 2 x 2 factorial design with species, sterilization, and vernalization as factors. We hypothesized that the use of a sterilization technique will increase germination and seedling survival rates.

Funding Source: Shield Ranch Foundation. Austin, Texas
Forgetting Autobiographical Memories via Suppression and Substitution

Samantha Wilkinson* & Amaris Maydon, Dr. Paula Hertel

In the traditional think/no think (TNT) paradigm developed by Anderson and Green (2001), participants learn cue-target pairs and are subsequently presented with cues and asked to either think about the target or to not think about (suppress) the target associated with the cue. The TNT phase results in better recall of cue-target pairs in the think condition due to retrieval practice and impaired recall of suppressed cue-target pairs when compared with baseline pairs. Stephens et al. (2013) applied this paradigm to autobiographical memories with similar results. The present study will also examine effects of suppression and retrieval practice on recalling the titles of autobiographical memories paired with common cues (e.g., concert, friend). We will also include a substitution condition, in which participants are instructed to not think about their negative memories by thinking about positive memories associated with the same cues. By modifying the TNT paradigm, we will be able to determine if it is possible to enhance the effects of suppression-induced forgetting of negative memories by practicing positive memories instead. Testing at a week’s delay will allow us to determine if these effects are lasting and subsequently useful to practical application for people who habitually ruminate about negative memories.


Funding Source: Murchison Summer Research Grant & US-Israel Binational Science Foundation
ALE Summer Internship:  
A Glimpse into Domestic Violence in San Antonio

Grace Williams*, Dr. Dante Suarez

The Arts, Letters, and Enterprise (ALE) Summer Internship Program is for students who are pursuing degrees in the humanities, arts, social sciences, or natural sciences who wish to gain supplemental business knowledge and skill. As a Psychology major, I was given the opportunity to engage with a local non-profit organization to further develop my professional skills and get a glimpse into the operations of an organization that provides services to individuals fleeing domestic violence. My time at the Battered Women and Children’s Shelter has allowed me to gain knowledge and comprehension in the area of family violence, teaching me how to constructively engage with individuals in abusive situations. My engagement with this organization has not only given me a look into the experiences of individuals living through abuse but also the public services that they frequently engage with. This internship has given me the tools to navigate the area of domestic violence from a personal and an organizational level in order to succeed in a professional nonprofit environment.

Funding Source: Arts, Letters, and Enterprise Minor
ALE Summer Internship: Blue Star Contemporary

Angela Wilson*, Dr. Erin Hood

The Arts, Letters, and Enterprise (ALE) Summer Internship program is designed for students in the sciences and humanities seeking to develop their business acumen while performing meaningful work with a local business or nonprofit organization. Working at Blue Star Contemporary this summer, I have learned that participating in this field requires a very well rounded professional.

My position as a public programs intern has enabled me to use many different skills that I have acquired during my education at Trinity University and some newly developed skills that I’ve acquired here at Blue Star Contemporary. The overarching theme of my responsibility was to aid the museum in their mission to educate the community about the Literacy of Art. Accomplishing tasks such as developing lesson plans for students, planning a new Blue Star Contemporary Reading Room, and creating websites, has allowed me to practice professional planning and communication skills, use my background of art interpretation and studio practice, and also develop teaching techniques. It takes a well-versed individual to adapt to an art museum setting. A small staff such as Blue Star Contemporary’s deals with public relations, exhibition planning, accounting, grant writing, membership program event planning and many more activities. This poster displays the role I played at the museum this summer and also where it has led me in navigating through my professional future. I have developed skills such as using Adobe Illustrator, Google Sketch, navigating Blue Star Contemporary’s database, its website design program, and archive system. I have been able to practice professional communication and planning skills and attend valuable meetings with Blue Star Contemporary staff and partners. I have gained experience in the planning of exhibitions and educational events. All of these experiences are interconnected with my role as the Public Programs intern, which has allowed me to explore my interest of museum activity, education, and contemporary art as a whole. As a result, I am motivated to continue in my progress of receiving a bachelor’s degree from Trinity in Studio Art, minoring in ALE, and then continuing on to enroll in a masters program. This experience has even shifted my study abroad plans, which now include the possibility of attending an internationally ranked art school in London. I am eager to further contribute to this field through my profession and support Blue Star Contemporary’s mission, which is to “To inspire the creative genius in us all by nurturing artists in an innovative contemporary art setting.”

Funding Source: Arts, Letters, and Enterprise Minor
Students+Startups Summer Internship: An Inside Look at a Software Startup

Laura Wilson*, Jason Straughan & Dr. Erin Hood

The Student + Startups program aims to immerse students of all academic backgrounds in San Antonio’s emerging tech and entrepreneurial ecosystem. As an Engineering Science student, working for Grok Interactive has allowed me explore a sector of the technology industry that I did not know much about before. I had three main goals for the summer: understand how developers and entrepreneurs problem-solve, develop basic skills in front-end software development, and communicate the company’s technical capabilities to non-technical clients. The technical projects I worked on involved HTML, CSS, Wordpress, and Amazon Web Services. The business development projects involved working alongside Grok’s sales team, clients, and other tech companies. I also learned the strengths of working at a young company with a self-directed, close-knit team.

This poster will highlight front-end web development, communication in the tech world, problem solving at startups, and San Antonio’s tech ecosystem.

Funding Source: 80/20 Foundation, Grok Interactive, LLC
GLO:
An App designed to help College Students Party Smarter and Safer

Bria Woods*, Dr. Luis Martinez

The Trinity Summer Startup accelerator is an opportunity for the Stumberg Competition finalists to accelerate their startups over the course of ten weeks. By attending workshops, networking sessions, programs, conferences, and scheduling countless meetings with local entrepreneurs I have been afforded a front row seat in entrepreneurship’s best classroom: experience.

After many iterations, I have pivoted to an app called GLO; which stands for Good Looking Out. The app is designed to help college students party safer and smarter by helping them get home safely. My poster will outline how the app works and how my business model will work to demonstrate how I can monetize the app.

Funding Source: Trinity University Entrepreneurship Center
Parental Alcohol Use Effects on Parkinson’s Disease in the Next Generation

Briahna Yarberry,* Dr. Mona Bains & Dr. James Roberts

Parkinson’s Disease (PD), the second most chronic neurodegenerative disease in the world, is characterized by resting tremors, bradykinesia, impaired balance and coordination, as well as a host of other motor and nonmotor symptoms. PD is caused by a degeneration of the dopamine-releasing neurons in the substantia nigra, a region of the brain that plays an important role in movement, and is known to be exacerbated by alcohol. Astrocytes, a type of glial cell in the brain, have been shown to protect neurons from degenerating by supplying lipids and cholesterol when the neuron faces oxidative stress. This transport is primarily mediated by Apolipoprotein E, or ApoE. Expression of ApoE has been found to be decreased in the offspring of rats who were both binge alcohol drinkers which we believe will lead to a decreased neuroprotective effect. This project will test the ability of the offspring’s astrocytes to protect neurons from an oxidative stress insult that mimics PD. Conditioned media from the astrocytes of control and ethanol-treated rat offspring was added to N27 dopaminergic neurons for pretreatment. MPP+ (1-methyl-4-phenylpyridium), a toxin that models PD, was then added to the N27s after removal of the astrocyte media. We propose that the astrocytes of these alcohol naïve offspring will offer less protection against MPP+ than astrocytes from offspring whose parents were not binge alcoholics.

Funding Source: Murchison Summer Research Fellowship
Evaluation of the Potential of Collagen-PEGDA Interpenetrating Networks for Nerve Tissue Engineering Using hMSCs

Rodrigo Zurita*, Zach Nickle*, & Rachel Tchen, Dr. Andrea Carolina Jimenez-Vergara & Dr. Dany J. Munoz-Pinto

Human mesenchymal stem cells (hMSCs) are multipotent cells, which can differentiate into chondrogenic, osteogenic, adipogenic or neurogenic cell lineages. In this work, we evaluated the potential of a double hydrogel network structure comprised of Type I Collagen and Poly(ethylene glycol) Diacrylate (PEGDA) to promote and support the differentiation of hMSCs into neuron-like cells. This versatile hydrogel platform allows for the control of the degree of cell spreading in a 3D context and the tailoring of the hydrogel stiffness and bioactivity. The mechanical performance of this platform can be adjusted to target a broad range of mechanical properties that simulate the physiological stiffness of brain, spinal cord, or peripheral nerve tissue. The phenotype progression of hMSCs was examined at the gene and protein expression level in terms of the differentiation markers Neuronal Specific Nuclei Protein (NeuN), Neuron Specific Enolase (NSE), Microtubule Associated Protein 2 (MAP2), Glial Acidic Fibrillary Protein (GFAP), Beta 3 Tubulin, Nestin, SRY-Box-2 (SOX2), and Galactocerebroside (GalC) in the absence and presence of soluble differentiation factors.

Funding Source: Trinity University Department of Engineering Science
Developing a Religious Diversity Profile of the City of San Antonio

Benjamin Collinger*, Dr. Simran Jeet Singh & Dr. Kiran Bains

San Antonio’s faith-based communities represent many of the most powerful civic institutions in the city. These communities encompass diverse constituencies that must be represented and included in governance. In recognizing the incredible influence of religious leaders and their networks, we have sought to build relationships with key stakeholders in faith-based organizations and gather data on religious diversity and inclusion in the city. In our fieldwork, we have found that a great degree of faith-based cooperation, dialogue and mutual understanding already exists among the religious groups of San Antonio. We have also found that the relationships among these groups are often fragmented along similar lines as the city in which they reside. Upon reviewing the results of our qualitative data, we believe there is a gap between the ideas of how inclusion can be advanced and the actions required to make these goals a reality. A key opportunity for growth is to promote better communication mechanisms among faith-based groups, as well as between the religious communities and the city government. In order for this to occur, diversity and inclusion practitioners must unite the complementary strengths of faith-based leaders and government officials. The City of San Antonio’s Diversity and Inclusion Office (DIO) is in a unique position to nurture this integration. The DIO can act as a neutral arbiter to continue promoting the city’s religious diversity while leveraging relationships within faith-based communities to develop programs that positively impact all the residents of San Antonio.

Funding Source: Mellon Initiative for Undergraduate Research in the Arts and Humanities

Brendan Kennedy*, Dr. Keesha Middlemass

Despite recent evidence suggesting that community support for policing is heavily tied to legitimacy and perceptions of fairness rather than police effectiveness, classical theories of strict social control have dominated crime policy for decades. This disconnect, combined with harsh racial disparities resulting from policing, bred national protests calling for criminal justice reform. Our study seeks to analyze San Antonio’s history, crime policies, and attitudes toward police in order to place it within this national context. Our research finds that San Antonio has a unique community with a large Latino population and stark economic rather than racial segregation. We also find that San Antonio Police Department has fairly progressive, community-oriented policies related to mental health, police militarization, transparency, and traffic stops, despite a number of controversial use-of-force incidents in recent years. To measure attitudes toward police, we collected 143 survey responses across San Antonio. Compared to the national context, San Antonio residents exhibit high levels of approval toward the police. Intra-city disparities include lower approval by minorities and young people, as expected, but also include differences in approval between different areas of the city, split opinions on emotionally disturbed persons and policing, and varying responses on how equally SAPD treats citizens.

Funding Source: Murchison SURF
The Varying Understandings of the Hijab in the 2016 Election

Iris Baughman*, Dr. Sarah Beth Kaufman, Dr. William Christ, & Dr. Habiba Noor

During the 2016 presidential campaign there has been a great deal of discourse regarding Islam and the place of Muslims within US society. One significant marker of Islam is the hijab, a veil worn by some Muslim women. This paper, which draws on qualitative interviews with a diverse group of 150 San Antonians, explores the religious, political and cultural meaning of hijab. The initial findings suggest contradictory understandings of the hijab occurring simultaneously. Interviewees describe the hijab in a variety of ways: as an empowering statement of culture and faith, conversely as a means to silence women and diminish their sexuality, as a signifier of cultural difference and inability to assimilate, and even as a concealing and mysterious signifier of terroristic threat. I will explore the differences and similarities between Muslim and non-Muslim respondents’ understanding of the hijab. I expect to find that for those outside the religion of Islam the hijab is a mysterious symbol of oppression and cultural difference, generating fear. For Muslims I expect to find that the hijab works as an empowering choice to express tradition and faith within the religion.

Funding Source: Mellon Grant
Islam vs. San Antonio: The “Islam vs. the West” Discourse throughout San Antonio

Matthew Long*, Dr. Bill Christ, Dr. Sarah Kaufman, & Dr. Habiba Noor

In the 2016 presidential election, candidates have associated the religion of Islam with physical and ideological violence against the United States. These associations are often reminiscent of the “Islam versus the West” rhetoric, famously seen in Samuel Huntington’s (1993) “The Clash of Civilizations?,” in which the values of Islam are characterized as being incompatible with those of the West. In our study of 150 semi-structured interviews across San Antonio, I found this rhetoric to be reflected in numerous respondents’ answers. In this paper, I will explore the socio-political and religious backgrounds of these respondents, examining the ways that their responses reflect the “Islam versus the West” discourse today.

Funding Source: Mellon Institute
Evangelical Understandings of Islam and the Conversion of Muslims to Christianity

Savannah Wagner*, Dr. Bill Christ, Dr. Sarah Beth Kaufman, & Dr. Habiba Noor

This paper addresses the issue of how Evangelicals make sense of their mission to convert Muslims in light of the presumed threat Islam poses to the United States. In this study, I draw on qualitative interviews with a diverse group of 150 San Antonians, 23 of whom belong to Evangelical churches. I show how conservative Evangelicals navigate relationships with Muslims in light of the need to convert them. I discuss how the Evangelical Christian identity acts as both sword and shield. On one hand, it drives out Islam through conversion; on the other, it assures a positive afterlife for Evangelicals should fears of terrorist attacks be realized. The process of conversion therefore saves both Muslims and Evangelicals from the presumed violence of Islam. Evangelicals thereby suggest a religious solution to the geopolitically framed “Islamic threat” by attempting to convert Muslims to Christianity.

Funding Source: Mellon Summer Undergraduate Research Fund
How San Antonians Use the Black Experience to Understand the Anti-Muslim Sentiment during the Presidential Election

Hanna Niner*, Dr. Bill Christ, Dr. Sarah Kaufman, & Dr. Habiba Noor

While scholarship has focused separately on the discrimination against Blacks and Muslims in the United States, I have found no work that uses the frame of the Black experience to explain anti-Muslim sentiment. This paper draws on 150 semi-structured interviews conducted with a diverse group of San Antonians during the summer of 2016 regarding the rhetoric around Islam during the Presidential campaign. Asked to describe how the current discussion around Islam relates to other points in history, numerous respondents used the historical and contemporary Black experience to explain the current conversation around Muslims. In this paper, I will analyze the racial identity of these respondents and examine what parts of the Black experience they draw upon to make sense of anti-Muslim sentiment.

Funding Source: Mellon Institute
Cinelatinidades: Gender, Sexuality and Cinema in the Americas

Diana Chavarria*, Cindi Marin* & Megan Medrano* Dr. Abreu-Torres, Dr. Blanco-Cano, & Dr. Urquijo-Ruiz

This interdisciplinary project examines Latin American and U.S. Latina/o films that analyze issues of gender and sexuality. These films emphasize the underexplored perspectives of women directors and queer (LGBTQ) cinematic identities from the 1990s to the present. Through the close examination of six films, Después del terremoto (1979), Havana Eva (2010), Madeinusa (2006), Mosquita y Mari (2012), Pelo malo (2013), and Que tan lejos (2006), an analysis was conducted on how these productions critically deal with cultural discourses that either prevent or enable agency for women and queers within the Latin American and U.S. Latina/o contemporary film industries. In addition, a close examination of cinematic styles revealed a break with traditional hetero-patriarchal visual conventions through innovative visual language, thus proposing that cinema is empowering for groups that historically have been ignored.

Funding Source: Mellon Initiative for Undergraduate Research in the Arts and Humanities
The Perceptions of Motherhood Status in the Professional Workplace

Endaisia Love *, Dr. Kathleen Denny

Research indicates that mothers in the professional workplace suffer a wage penalty in comparison to their male colleagues that cannot solely be attributed to tangible qualifications like experience and education level. The discrepancies in wage are thought to be partially attributable to a bias towards mothers in the professional workplace because having children is thought to lower competency and commitment at work. The assumption is that motherhood status trumps the role of worker or employee. Using data from a vignette experiment consisting of 2,010 respondents, I analyze how childless women and women identified as “highly involved” mothers are rated on expected commitment and lateness. As a result of the bias toward mothers, childless women are rated more favorably than highly involved mothers overall. However, there are important differences by race. Latina mothers are most penalized relative to their childless counterparts. In contrast, highly involved Asian mothers benefit from motherhood status, being perceived as more committed and less likely to be late than childless Asian women.

Funding Source: Murchison Research Fellowship
Santa Fe Fiesta and Identity Management among LGBT Participants

Georgina Cortinas*, Dr. Amy Stone

The notion of identity as a reflexive process dependent on responses to external interactions is an established concept in discussions of selfhood. Although there is literature on Santa Fe Fiesta, it has not yet been examined in relation to the city’s large LGBT population. This research draws from nine interviews with members of Santa Fe’s Fiesta and/or LGBT communities, and focuses on two interviews with gay Catholic Latino men to investigate how heteronormativity, religion, and the legacy of colonialism in Santa Fe may create a conflict of identity for gay men who participate in Fiesta. An analysis of the way these men relate to the two most prominent symbols of Fiesta (La Conquistadora and Don Diego de Vargas) reveals the ways in which they grapple with conflicting aspects of their identities. I found that participating in this religious event can be a struggle for gay men, not only because of anti-gay religious sentiment, but also because of the prevalence of machismo and marianismo in Fiesta’s representations of gender. Deciding to manage one’s gender and sexuality in order to maintain their participation in Fiesta may breed homonormative preferences and discomfort with feminine men, a harmful possibility for members of Santa Fe’s LGBT community who do not follow homonormative practices.

Funding Source: Mellon Initiative
House of Light: Women Making Comics

Robyn Wheelock* & Katie Groke*, Dr. Jennifer Henderson & Dr. Aaron Delwiche

The purpose of the House of Light Project is to provide students with experience in creating a full-color, professional comic book. The project serves as a response to the situation women in comics and the comic book industry. Women currently make up a small fraction of comic writers, authors, and creators as well as comic characters; when they appear in comics as characters, women are often cast as damsels in distress or hypersexual femme fatales, and often lack the agency afforded to their male counterparts. Additionally, well developed women of color and queer women are even more few and far between than straight white women.

We began our research by analyzing first issues from a variety of comic series, for standard practices, art, and narrative storytelling techniques. As House of Light revolves around a coven of witches, we researched the role of Witches in History and Culture to better contextualize our work. Over the following weeks, we wrote several drafts of the script and designed a cast of seven characters. Drawings were created within Adobe Illustrator while text boxes were created in Adobe Photoshop to be overlaid in the Illustrator files.

The final product is a comic book by women, that aims to be enjoyable, interesting, and, as the series continues, relevant to the continuing dialogue on intersectional oppression and empowerment.

Funding Source: Mellon Foundation
Santa Fe Fiesta: Understanding Spanish and Native American Identities and Cultural Representation

María Olalde*, Dr. Amy Stone

For the past three hundred years, Santa Fe, New Mexico has been celebrating Fiesta. Fiesta is the celebration and reenactment of Don Diego De Vargas’ reentry into Santa Fe accompanied by La Conquistadora, a statue of the Virgin Mary, and the “peaceful reconquest” of the land. Over the years, Fiesta has evolved into a pageantry in which local women and men run to become apart of the Fiesta Court that consists of La Reina, Spanish and Indian Princesses, Don Diego De Vargas and the Quadrilla. This study was designed to help us develop an understanding of how Spanish and Native American identities and cultures have been represented through Fiesta. Specifically, how in previous years local protesters have challenged those representations.

The methodology included participant-observation, archival research and nine interviews with local residents that were collected during a two-week period in Santa Fe. Participant-observations were conducted at local Fiesta events. This study found that Fiesta reinforces, and preserves a specific type of Spanish identity and that often excludes individuals that identify as Hispanic or Latino. Similarly, Fiesta’s narrative misrepresents the reconquering of Native Americans as a peaceful interaction rather than Spanish dominance over Native Americans. Furthermore, while locals have challenged the narrative and misrepresentation of Native Americans, the Spanish identity and heritage has not been challenged. While Fiesta is a tradition that is meant to unite the city of Santa Fe, the misrepresentation of Native Americans can cause uneasiness and unwillingness to participate. Ultimately, addressing the racial disparities and Spanish dominance in the Fiesta narrative can produce an open space in which everyone within the Santa Fe community can participate in Fiesta.

Funding Source: Ronald E. McNair Postbaccalaureate Achievement Program, Mellon Initiative
Published in 1961 amidst the Eichmann Trial, *The Pawnbroker* is a fictional novel about a Holocaust survivor by Jewish American novelist Edward Lewis Wallant. The setting takes place in Harlem, wherein the survivor, Sol Nazerman, works as a pawnbroker with his assistant, Jesus Ortiz. Nazerman re-experiences painful, intrusive memories of his experiences in the concentration camps that are narrated in the text through vivid, interspersed nightmare sequences. The story follows Nazerman’s progression from isolation to his rebirth into the community. This study examines the flashbacks in the novel and the 1965 film adaptation directed by Sidney Lumet, through a synthesis of scholarly research, trauma theory, as well as discussing the complexities of Holocaust representation. This research will contribute to Dr. Aarons’ chapter on *The Pawnbroker* in her upcoming publication *An Introduction to the Holocaust.*

Funding Source: Mellon SURF
Words are often insufficient in effectively portraying the trauma of the Holocaust, for, according to Samuel Beckett, “[e]very word is like an unnecessary stain on silence and nothingness.” Language alone cannot convey the depth of emotion embroiled in what someone experiences when subjected to such atrocities. My paper addresses this insufficiency of language, particularly in regard to the graphic novel, a genre that contributes to post-Holocaust literary representation. I examine nine different works to analyze how the art and text collaborate to portray trauma. More specifically, I discuss how the omission of information—through hiding scenes, erasing identities, and avoiding language—and the contrast of colors and ideas reveal a depth of emotion that attempts to enact trauma and atrocity. I argue that the graphic novel utilizes these rhetorical and visual devices to emphasize the inexplicable while adhering to the rupture that accompanies attempting to communicate trauma. In conclusion, my research paper, through its analysis of these various graphic novels, advocates the necessity of the visual when language itself fails to convey the extent of suffering experienced by those affected by the Holocaust.
Second-Generation Holocaust Narratives and the Intergenerational Transmission of Memory and Trauma

Olivia Mill*, Dr. Victoria Aarons

My research is part of a larger book project on the literary representation of the Holocaust and will contribute to a chapter on the writing of second generation Holocaust “witnesses,” the children of Holocaust survivors. My research addresses the defining characteristics of the second generation, with an overview of the central patterns that emerge in the study of survivor families and their children. My work examines how children of Holocaust survivors have inherited their parents’ experiences as postmemories, how the Holocaust has affected their lives and development in complex ways, and how the profound event shapes the literature that they produce. The research paper that has emerged from my work examines three works in particular as examples of the ways that the second generation explores its connection to the Holocaust and preserving the memory of those who experienced the Nazi genocide: Art Spiegelman’s two-part graphic novel Maus, and Thane Rosenbaum’s collection of short stories, Elijah Visible and novel, The Golems of Gotham. The investigation of these works emphasizes the ways in which the texts reveal important aspects about what it means to inherit memory and trauma, and ultimately calls on its readers to share in the burden of remembering and memorializing the events of the Holocaust.

Funding Source: Mellon Initiative Grant
Analyzing the effect of exposure to first person narrative of a death-row inmate on the support of capital punishment

Kevin Rodriguez*, Dr. Kathryn Anderson

Does the presentation of the story of a death-row inmate decrease the degree of support toward capital punishment in a sample of undergraduate students? The independent variable is whether participants are presented with an anecdote of the story of a person or death row or the story about the inmate presented by his brother. Thus the intervention methods in the study include students introduced to first-person information and third-person information. The dependent variable is the degree of support toward the death penalty, measured both before and after exposure to the story. The sample will consist of 100 undergraduate students from a Catholic institution that will be randomly assigned to the type of information. Results will be analyzed using the t-test for independent samples. It is expected that the students exposed to first-person information (the inmate’s story) will demonstrate more of a decrease of support toward capital punishment than those students exposed to third-person information (his brother’s story).

Funding Source: Ronald E. McNair Postbaccalaureate Achievement Program
Vaca Muerta’s Global Opportunity

Liliana Diaz*, Dr. Thomas Tunstall & Dr. Javier Oyakawa

Volatile oil prices have significantly reduced oil and gas drilling activity worldwide, however operators have been positioning themselves to tap into the potential of the next “big unconventional play.” Vaca Muerta is a shale basin located in Argentina and in terms of comparison to U.S. shale plays, the Eagle Ford in south Texas comes closest when several key geological parameters are considered. While Vaca Muerta is much larger in size and has strong prospects, there are several factors that could keep it from reaching its full potential. These include a limited number of engineers and specialized workers, insufficient infrastructure exploration laws, investors, etc. This study will investigate the degree to which these factors will affect the drilling in Vaca Muerta and determine if the region can put in place the necessary infrastructure to make it comparable to the Eagle Ford in terms of oil and gas production by applying lessons learned in Texas.
A Tradition of Change: Text and Paratext in Urry’s Chaucer

Emily Wood*, Dr. Andrew Kraebel

The early editors of Chaucer were deeply entrenched in their own print tradition, in which the text of the previous edition was essentially copied with each new printing. Urry’s 1721 edition of Chaucer’s works has often been dismissed as a text of low quality that was simply the last of this early tradition before the development of the modern critical edition of Chaucer. Thus, it has rarely been a topic of scholarly study, but it still stands as a significant step in the history of editing Chaucer. Though the editors of the 1721 edition largely stayed true to the early print traditions surrounding Chaucer’s works, they make limited but substantive changes to the introductory notes prefacing many of the included works, an example of the editors’ engagement with the previous edition and the gradual advancement of this critical tradition.

Funding Source: Mellon Initiative for Undergraduate Research in the Arts and Humanities
Grave Witness: The Circulation and Manuscript Forms of Richard Rolle’s Lessons of the Dead

Kathryn Funderburg*, Dr. Andrew Kraebel & Dr. Michael Hughes

Although medieval texts are typically preserved today in bulky manuscripts bound between two hard covers, throughout the Middle Ages they circulated in a greater diversity of material forms. Large volumes were certainly produced, but medieval readers more frequently encountered texts in softbound booklets or even smaller parchment pieces. Though these alternative codicological forms rarely survive today as discrete units, evidence for their existence, and for the important role they played in the dissemination of specific texts, can nevertheless be identified in other, bigger manuscripts. One such text is the English mystic Richard Rolle’s commentary on the Lessons of the Dead. Written in the fourteenth century, this text presents Rolle’s analysis of nine reading from the book of Job which featured prominently in the Church’s liturgical commemoration of the faithful departed. Rolle’s text is preserved in over fifty manuscripts, sometimes as a stand-alone text, sometimes as part of a larger anthology as a previously discrete booklet that is now bound with other materials, or in a collection of Rolle’s writings. Widely copied but rarely studied, Rolle’s commentary has the potential to tell us more about both the devotional reading practices of the late-medieval English clergy and the now less readily accessible material forms in which such devotional texts were read. Having surveyed the contents and formal details of all of the surviving manuscripts, my paper will focus on Bodleian manuscripts 52 and 315, and will seek to define more specifically the wide range of contexts in which his work was read.

Funding Source: Ronald E. McNair Post baccalaureate Achievement Program
Textual Harassment

Rachel Lawson*, Dr. Erin Sumner

Textual harassment refers to a form of technology-enabled abuse in which individuals are harassed, stalked, or bullied via text-based short-messaging services (SMS). This project will use grounded theory and analysis of narratives to qualitatively explore the themes that are present in victims’ accounts of being textually harassed. Data will be drawn from the transcripts of seven focus groups in which victims of textual harassment discussed their experiences. Results will discuss themes that emerge within the following elements: the relationship of textual harassers and their targets; and the character traits that the targets assign to their selves and the harassers.

Funding Source: Mellon SURF
Empowering the Passive: Implications of Increasing NGOs and their Impact on North Korean Refugee Resettlement in South Korea

Sabrina Sha* and Elena Wilson*, Dr. HJ Yoo

Our research focuses on the role South Korean governmental and non-governmental networks play in socializing North Koreans living in South Korea. Without proper experience of capitalist and democratic systems, the defectors experience a number of difficulties in adapting to the new society with respect to finding jobs, securing housing, getting education, and learning a new culture. The increase of North Korean defectors living in South Korea since the early 1990s has demanded a variety of organizations to be involved in the process of facilitating assimilation. While the South Korean central government provides initial institutional support, local governments and non-governmental organizations (NGOs) comprise much of support system that participates in helping these defectors resettle.

We will examine the present complex network of government and NGO programs, as well as the discrepancies between them regarding the types of programs offered, budget allocations, and underlying political motivations and goals. We will evaluate the support programs offered to these North Koreans, identifying the fundamental differences not only between the two network groups, but within each group itself. Using archival research, empirical studies, and interviews, our research addresses three critical components: 1) the link between the government and NGOs, 2) the interaction amongst various NGO groups, and 3) the efficacy of governmental policies geared towards resettlement. This study explains how such marked discrepancies affect the success of resettlement policies and programs and what these programs ultimately mean for North Koreans living in South Korea.

Funding Source: Murchison Fellowship and Mellon Summer Undergraduate Research Fellowship (SURF)
I maintain that in whatever sense something can be, say, music and also an artwork, something can be a game and an artwork. Contrast this position with Brock Rough’s incompatibility thesis, according to which artworks and games are incompatible kinds: if something is a game, then it cannot be an artwork, and vice versa. First, I will explain one highly plausible definition of games, defended by Bernard Suits, to show that it is compatible with Rough’s claim that proper engagement with an artwork requires one to attend to the work’s artistically relevant features with the goal of attaining an appreciation for that work. I will then summarize my account of how there can be such things as games that are artworks before addressing one of Rough’s arguments for his incompatibility thesis.

Funding Source: Mellon Initiative
LIGO Interferometer for Undergraduate Physics Labs

Sean Farrell*, Dr. Dennis Ugolini

The Laser Interferometer Gravitational-Wave Observatory (LIGO) uses a modified Michelson interferometer to measure gravitational waves. We developed a set of affordable (under $2,000) experiments to educate undergraduate physics students on the differences between LIGO and the basic Michelson interferometer.

We first built a delay line, which consists of an optical cavity misaligned to create four separate output beams. Through sweeping the cavity length, we observed that the number of fringes is proportional to the number of reflections within the cavity. Although LIGO does not use a delay line, it is a useful tool to understand phase response.

Next we added a Fabry-Perot cavity to sharpen the original Michelson fringe pattern. We found our round trip reflectivity to be a factor of 0.38±0.02 allowing us to then calculate our theoretical fringe sharpness to increase by a factor of 4.1±0.2. We then experimentally measured the fringe width with and without the cavity and found the ratio to be equal to 3.7±0.2. This experiment demonstrates why LIGO’s interferometer arms consist of Fabry-Perot cavities to increase the sensitivity.

The Fabry-Perot cavities in LIGO need to be kept at an integer number of wavelengths. This is accomplished by creating a linear response to cavity length called the Pound-Drever-Hall error signal. We generate this signal by applying a beat to the laser, before it travels into the cavity, through another PZT-mounted mirror running at a frequency of 43.7 kHz. The interferometer output is sent to a photodiode that is connected to a lock-in amplifier, which mixes the cavity frequency and beat frequency to create a linear plot of the light intensity as the cavity sweeps through resonance. We demonstrate this with both a commercial and a homemade lock-in amplifier.

Funding Source: Murchison SURF
Using an Electrostatic Force Microscope to Detect Surface Potential

Matthew Jenkins*, Dr. Dennis Ugolini

An electrostatic force microscope (EFM) was used to detect surface potential and decay rates of electric charge on silicon oxide and fused silica surfaces. An EFM detects surface charge by applying a voltage to a conductive, micron-sized cantilever. The cantilever is vibrated at a resonance frequency, and when it passes over surface charge its oscillation changes phase quadratically with respect to applied voltage. The peak of the resultant parabola is equivalent to the surface potential.

By optimizing the free-vibration amplitude, measurements per data point, and tip-to-sample distance, noise for the silicon oxide surface was reduced to a standard deviation of 40 mV (equivalent to four electron charges). The sample was charged by applying a constant voltage to the tip and touching the tip to the surface. The EFM detected increased voltage where the surface was charged, successive measurements showed the voltage decayed, and it was also proven that this was not the result of the cantilever removing charge from the surface, but rather the result of humidity. Decay rates were determined for both air at 50% humidity, as well as nitrogen at 20% humidity. Time constants were \((293\pm6)s\) for air and \((2.74 \pm 0.04) \times 10^3\) s for nitrogen.

For the fused silica surface, the noise was 300 mV. Limiting factors included the EFM not recognizing the correct distance to the surface, and large (greater than 10V) potential fluctuations in low-humidity environments. Noise-reduction efforts are still ongoing in order to obtain time constants for both air and nitrogen.

Funding Source: National Science Foundation grant PHY-1404269
Bacterial Chemotaxis: Models and Experiments

Danielle King*, Kristen Rundstein*, & Melissa Whitman*, Dr. Hoa Nguyen, Dr. Frank Healy & Dr. Hakan Basagaoglu

Motile bacteria such as *Escherichia coli* sense and respond to chemical concentration gradients through interactions between chemoeffectors and cognate receptor proteins. These interactions initiate signal transduction events that govern the direction of flagellar motor rotation. Motor rotation activity in turn controls whether the organism will change its current direction of travel or continue to run in the same direction. While bacterial cells exhibit active responses to environmental stimuli, the fluid environment also exerts forces on chemotactic organisms as well as passive particles which affects the trajectories of these cells and particles. We are interested in developing computer models and experimental methods to better understand the behaviors of chemotactic bacteria and passive particles. Our computational approaches implement lattice-Boltzmann (LB) and coupled LB RapidCell models to simulate the behaviors of particles and chemotactic bacteria in a variety of fluid/chemoeffector environments. These include Newtonian/non-Newtonian and stagnant/flowing fluids as well as competing chemoeffectors. In competing chemoeffector simulations, we found bacterial motility to be governed by receptor sensitivity rather than attractant concentration. We are validating simulations using quantitative capillary-based chemotaxis assays with suspensions of motile *E. coli*. In these experiments, we have found bacteria to preferentially swim into glass capillaries containing a flowing gradient of amino acid attractant and are currently optimizing the assay to investigate how cells respond to multiple adjacent gradients of different chemoeffectors.

Funding Source: National Science Foundation
Correlation of Mass Transport Phenomena Controlling Evaporation

Gregory Wassom* & Chris Nkinthorn*, Dr. Peter Kelly-Zion, Dr. Chris Pursell, & Dr. Hoa Nguyen

The goal of our research is to understand how the evaporation of a sessile drop is controlled by the two vapor-phase mass transport mechanisms, diffusion and convection. To learn how the two mechanisms influence evaporation, a relatively simple correlation is developed to fit measured evaporation rate data taken over a broad range of conditions. The intention is to use the correlation to help reveal the complex coupling between the two transport mechanisms and the physical properties on which those mechanisms depend.

The evaporation of small, pinned, sessile droplets has traditionally been thought of as a diffusion-limited process, i.e. the rate of evaporation is determined by the rate of diffusion of the vapor away from the liquid surface. That is, limited by the diffusion of vapors away from the liquid surface. However, studies in our laboratory have shown that the evaporation of sessile droplets is also affected by buoyancy-induced convection, a bulk transport process that is driven by a density gradient, not included in diffusion-based models.

The mass transport mechanisms that control evaporation and are used to correlate evaporation data. Our approach in deriving a simple correlation that contains the basic physics is in contrast to modeling the evaporation process by solving the fundamental conservation equations, which is a set of simultaneous differential equations that are difficult to solve and do not result in a single mathematical expression that elucidates the basic physics of the process.

In developing our model we have used data from a very broad range of conditions, our research collected including hydrocarbons from hexane to octane as well as methanol and acetone. Rates of diffusion and convection were altered through the use of a variety of background gases over a broad pressure range, as well as by controlling the droplet size.

Funding Source: Petroleum Research Fund
Computational Model for Mass Transport Phenomena Associated with Evaporation

Michael Batista*, Chris Nkinthorn*, & Gregory Wassom*, Dr. Hoa Nguyen, Dr. Peter Kelly-Zion, & Dr. Chris Pursell

A computational model of an experimental technique was developed in order to evaluate the uncertainty in the experimental results. The experiment measures the distribution of vapor above an evaporating sessile drop. The characteristics of the vapor distribution reveals information about the transport phenomena that can control the evaporation process, which is the subject of our research. The analysis of the experimental data involves complicated mathematical procedures and consequently the resulting uncertainty in the experimental results is difficult to assess. In order to compute and evaluate the uncertainty in the experimental results, a computational model of the experiment was developed and the uncertainty is being evaluated for each step of the mathematical data processing. If the computational model indicates that the uncertainty in the experimental results is sufficiently low, then quantitative analysis of the measured vapor distribution can be a very valuable tool for learning about the vapor transport phenomena controlling evaporation.

In order to test our computational processes, two codes were developed in MATLAB. The first code was devised to mimic our experimental concentration detection procedure. The code applies randomly generated noise to a theoretical diffusion-limited model for the vapor cloud distribution above an evaporating droplet. The noise was devised to resemble uncertainty in our experimental measurements for the purpose of determining the accuracy of the procedure in regards to application with experimental data. The second code was developed to use the theoretical vapor distributions mentioned above to compute global evaporation rates. Concentration data was used to compute local flux of vapor away from the droplet surface using different control volumes mapped in the vapor cloud. The summation of the local flux surrounding a control volume was then computed, resembling the global evaporation rate through that control volume. Our results will be described in detail during the presentation.
Using Deep Learning to Classify Mutations

Evan Cofer*, Dr. Matthew Hibbs

Accumulation of somatic mutations may contribute to the development of cancers and the functional decline associated with aging. However, the rate and extent of somatic mutation accumulation in otherwise healthy cells is poorly quantified at present, as estimates range from 10 to $10^5$ mutations per cell. Somatic mutation rates for any complex organism likely vary between heterogeneous tissues and over the course of an individual’s lifespan. As such, we have collected extensive time series DNA-seq data for two well-defined strains of *Mus musculus*, each with a distinct aging phenotype. Existing approaches for somatic mutation detection are largely designed for oncogenomics, and are not entirely appropriate for whole-genome aging research. To remedy this, we have created an algorithm for accurately determining the incidence rate of somatic mutations in complex DNA-seq data. Through its use of a sophisticated deep neural network machine learning model, our approach is able to detect rare sequence variations, while accounting for the systematic noise intrinsic to high-throughput sequencing technologies. With this neural network we hope to determine strain-specific rates of somatic mutation accumulation *in vivo*. Work is underway to determine if the observed somatic mutation rates are stochastic, or driven by selective pressures, as this may explain how they accumulate differentially across subspecies.

Funding Source: Trinity University & HEP Fellowship
Graphing Large Hierarchical Structures

Zach Zimdars*, Dr. Matthew Hibbs

Large graphs have become quite popular for representing and visualizing complex entities and the relationships between those entities in a wide range of applications. The reason for this is when looking at large amounts of data, people typically don’t notice subtle patterns in raw data or numbers as well as they do when it is visualized. Graphing large, fully connected networks has been a long-standing issue of study that has been researched in a number of ways. For example, some efforts use computational power to instantiate a spring algorithm that helps layout and beautify the node structures. Another approach utilizes edge weights that are either shown by the thickness of the edge, or by how close the nodes are together. One example of a large graph is a yeast gene interaction network that has upwards of 5000 nodes and 12.5 million edges, representing biological relationships between genes or proteins.

The objective of this project was to investigate methods to create fully connected, hierarchical graph visualizations for large networks, up to five times the size of a yeast network. In order to do this, there are some problems that need to be assessed, such as transmitting large amounts of data to a user over time, rather than all at once, which could be quite costly. Another is dealing with which edges and nodes to show in order to ensure that the graph isn’t too cluttered during examination. Our approach uses a hierarchical structure in the graph to achieve fast-paced loading times, and to ensure an interpretable view for the user. This allows for faster rendering times though interactive graph expansion and contraction driven by a user to explore the areas of interest within a much larger network structure. We plan to utilize this approach to interactively visualize a number of mammalian interaction networks online.

Funding Source: Trinity University
Social Network Tolerance Research through Multi-Agent Systems Simulation

Po-Hung Lin*, Dr. Yu Zhang

Multi-agent systems have been used to simulate interpersonal relationships and communication in a variety of studies. Today, with the increase of social interactions, studies related to social networks have relied on multi-agent system simulations to deduce certain characteristics of network relationships and interactions. To observe real human interactions with the help of such simulation requires extensive research on the impact of inter-agent communications. This research study aims to identify certain aspects of human interaction and reflect these findings upon a proposed social network simulation construction. By recognizing certain variables that contribute to an agent’s decision making process, we attempt to create an adaptive simulation that learns trends from given datasets using an iterative form of the Q-learning algorithm. Finally we will compare our simulation results against real collected social network data to analyze and assess the variations.

Funding Source: Murchison Undergraduate Research Fellowship
The Physics of the Relativistic Jet in Quasar 3C207

Samuel Studebaker*, Dr. David Hough

Quasi-stellar radio sources, known as quasars, are the most powerful and distant galaxies in the class of active galactic nuclei (AGN). These quasars, which are typically further than 1 billion light years away, allow us to look back into a much earlier universe. A quasar emits an extremely large amount of power from its core region surrounding a supermassive black hole. This black hole’s gravitational energy is converted into thermal radiation in the form of an accretion disk. Matter is ejected near the black hole in the form of a relativistic jet reaching velocities near the speed of light and spanning millions of parsecs before depositing it in remote lobes. Our knowledge of these jets and the physics behind their motion is still limited. The quasar 3C207 has been continuously observed over the last 30 years with its first observations dating back to 1981. This wealth of data has led to the development of a precessing jet model (“swinging cannon”) to explain the variations in the jet’s direction, speed, and acceleration. These variations are made apparent through plasma ‘blobs’ ejected from the core region that travel down the jet.

We received the interferometer data from the National Radio Astronomy Observatory’s (NRAO) Very Long Baseline Interferometer (VLBI) for three frequencies and undertook rigorous procedures to perform amplitude and phase calibrations for 3C207 and three other calibrator sources. After calibrating the data, polarization tables were applied to 3C207 to image the source in both total intensity and polarized flux. The lowest frequency images (5 GHz) show the jet extending up to 30 milliarcseconds, with the furthest plasma ‘blob’ at 20 milliarcseconds. The images also revealed that total intensity is dominated by the core region closest to the black hole. Although the jet is significantly weaker in total intensity, it has higher fractional polarization than the core region. We believe this is a result of the jet’s magnetic field alignment further down the jet. The electric field of the radio emission, which is along the polarization vectors, is nearly north-south away from the core region. This means that the jet magnetic field, which is perpendicular to the polarization vectors, runs parallel down the jet. On the other hand, the core region contains polarization angles that vary between the three frequencies, indicative of Faraday rotation. We also observed a nonlinear motion in the jet. The jet appears to ‘swing’ as the inner jet exits the core region southward before swinging north and then south again. This motion is irregular and does not exhibit any noticeable pattern. The jet components being monitored to measure the jet’s velocity showed no changes since the last observation in 2010. The component J2 had previously undergone acceleration but appears to have returned to a constant speed. Two new components appeared. The first one appears to be exiting the core region, further south than previous components and consistent with precession. However, a new component appeared further down the jet that had been previously undetected. We believe this part of the jet underwent a ‘shock’ that resulted in an increase in electromagnetic emission.
A Language for Visualizing Dynamical Systems

Charles Stein *, Dr. Seth Fogarty

Dynamical systems, a booming field of mathematics, model systems that change over time, such as election outcomes, survival of endangered species, or fluid dynamics. These systems have complex behavior, and mathematicians use visualizations to illustrate their properties. Unfortunately, hand-drawn illustrations are time consuming and difficult, and computer-generated images requires technical expertise and is error-prone. We have designed and implemented dsmodels: a uniform, expressive language for visualizing dynamical systems.

Most of the current research on dynamical systems studies 2-dimensional models: systems that have two interacting forces, for instance the populations of two competing species. Mathematicians examining these models study features, such as which conditions will result in population growth, or the boundary below which a species will go extinct. The dsmodels language can easily create two-dimensional images visualizing these systems. Features can be added to display the movement of the entire system, or to highlight specific areas of interest. To ease rapidly creating figures, dsmodels uses color gradients to show evolution over time, and can even guess regions of interests.

Funding Source: Trinity University Murchison SURF
Surface Plasmon Enhanced FRET: Varying the Acceptor Concentration

Chae Ramnarace* & William Farner, Dr. Jennifer Steele

A surface plasmon is a collective oscillation of delocalized electrons in a metal, which results in an intense electromagnetic field near the surface of the metal. In this project, we excite surface plasmons on a gold grating with 500nm periodicity. Gratings were produced using soft lithography by molding polydimethylsiloxane (PDMS) to purchased master patterns. Surface plasmons can enhance fluorescence through two mechanisms: 1) enhanced excitation when the wavelength of the surface plasmon is close to the absorption wavelength of the fluorophore, 2) a second decay channel is introduced for the excited fluorophore which, according to Fermi’s Golden Rule, decreases the decay constant of the system. Previous studies of this system indicate that the latter is the dominant enhancement mechanism.

Förster Resonance Energy Transfer (FRET) is the transfer of energy between two fluorophores. FRET occurs when there is an overlap between the emission and absorption spectra of a donor and acceptor fluorophore respectively. The rate of energy transfer is proportional to the distance between the donor and acceptor molecules, allowing for measurement of distances at the sub-nanoscale. We found that increasing the concentration of acceptor molecule caused a linear increase in the fluorescence. We also found that the enhancement was consistent across all concentrations.

Funding Source: WM Keck Foundation
Gamification of the Linux Command Line

Zackery Kiyoshi Kurima-Blough*, Dr. Matthew Hibbs

The definition of gamification is the application of typical elements of game playing (e.g., point scoring, competition with others, rules of play) to other areas of activity, often as an online marketing technique to encourage engagement with a brand, or increasingly as an educational tool. This concept has been used/studied for many years. The one thing about games that is still being thoroughly studied is what makes a game “fun.” This may seem like a trivial question, but diverse games, from Zork, to Pokemon Go, to Overwatch, to Her Story, all use very different mechanisms to engage users in "fun" activities. Many users still find the classic text adventure to be effective, and such a system is well suited for educational applications in some areas of computer science.

In this project, I have created a gamified system to teach a subset of the linux bash command line which contains the basic features useful for a student in an introductory computer science course. Since introductory students are not the only users who would find this system useful, there is the ability to create the entire linux bash command line as well as create your own text adventure with some coding/unity knowledge. Here, I will present some of the challenges faced in creating this system from both a programming standpoint as well as a game design standpoint. There are many games that function similarly to what I have created with this framework. When you analyze these games and there is currently no other framework which allows for customization of a text adventure using the linux bash command line.

Funding Source: Trinity University
Förster resonance energy transfer (FRET) is a mechanism describing energy transfer between two fluorescent molecules. A donor fluorescent molecule is excited by a light source (e.g. a laser), but instead of decaying back to the ground state by emitting a photon, the energy is transferred to an acceptor molecule, which in turn emits a photon. The efficiency of this energy transfer is extremely sensitive to the distance between the donor and acceptor molecules, which makes FRET a reliable measurement of distance.

A surface plasmon (SP) is an oscillation of electrons on the surface of a metal. SPs induce large electromagnetic fields, which can enhance fluorescence through two mechanisms: enhanced excitation when the SP wavelength is close to the fluorescent molecule’s absorption wavelength and a second decay channel introduced for the excited molecule that decreases the decay constant of the system. Previous studies of this system indicate that the latter is the dominant enhancement mechanism. This project focused on enhanced FRET emissions from donor-acceptor molecule pairs using surface plasmon enhanced fluorescence on gold nanogratings. Gratings with periods of 500nm were manufactured from silicon master gratings using polydimethylsiloxane (PDMS) molds. Grating quality was verified with atomic force microscopy (AFM). White light measurements were taken to determine the SP modes of the gratings. For this project, the concentration of the acceptor was kept constant while the concentration of the donor was varied. We found that the relative fluorescence for both the donor and acceptor molecules varied directly with concentration, and the enhancement was mostly consistent for all concentrations.

Funding Source: WM Keck Foundation
The ZO-1-ZU5 domain and its Function

Krista M Kannen*, Nicole C Thomason*, & Zilin C Tian*, Dr. Jonathan King

Zonula occludens-1 (ZO-1) is a cytoplasmic scaffolding protein that structurally and functionally tethers cytoskeletal components and membrane proteins at the tight junction. Interestingly, ZO-1 has a poorly characterized ZU5 domain at the carboxy-terminus that ZO-2 and ZO-3 proteins lack. The goal of this study is to examine ZO-1-ZU5 function in a structurally defined manner. The study has used multiple approaches to examine ZU5 domain interactions and measure epithelial barrier function. To determine ZO-1-ZU5 domain function, EGFP-ZO-1, EGFP-ZO-1ΔZU5 and EGFP-ZO-1 constructs mutated within the ZU5 domain hydrophobic pocket were engineered and stably transfected into low-resistance MDCK lines. FRAP analyses show that EGFP-ZO-1ΔZU5 rapidly recovers and the mobile fraction (Mf) is elevated compared to EGFP-ZO-1. Disruption of the ZU5-hydrophobic pocket caused similar changes suggesting the ZU5 domain participates in stabilizing ZO-1 at the tight junction. Macromolecular flux studies demonstrated that ZO-1ΔZU5 expression enhances leak pathway permeability compared to EGFP-ZO-1. These data indicate that the ZU5 domain stabilizes ZO-1 at the tight junction and contributes to development of the barrier to paracellular flux of small solutes.

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A comparison of germination rates with four vernalization treatments in six *Asclepias* species

Olivia Roybal*, Molly Lenihan*, & Lavanya Hospeti, Dr. Kelly Lyons

Vernalization, a process that induces germination through exposure to cold temperatures, is important for the germination of many temperate plants. Milkweed (*Asclepiadaceae*), an essential plant in the life cycle of the monarch butterfly (*Danaus plexippus*), is thought to exhibit interspecific variation in vernalization needs. Both the USDA and local organizations in Texas have expressed interest in propagating milkweeds for the purpose of supplying oviposition sites for the monarch butterfly (*Danaus plexippus*), but data regarding best practices for seed germination are lacking.

The study focused on six milkweed species, *A. asperula*, *A. incarnata*, *A. speciosa*, *A. syriaca*, *A. tuberosa*, and *A. viridis*. We hypothesized that germination in *A. tuberosa*, a tropical species, would not require vernalization, while germination in the temperate species, *A. asperula*, *A. incarnata*, *A. speciosa*, *A. syriaca*, and *A. viridis* would require a minimum 10 day vernalization treatment. Each species was subjected to four levels of vernalization: 0, 10, 20, and 31 days. Four replicate Petri dishes were established for each species by vernalization combination and each Petri dish contained ten replicate seeds. Seeds were placed in a labeled Petri dish lined with No. 4 filter paper moistened with deionized water and covered with Parafilm. For each treatment combination we measured days to radicle (embryonic root) emergence, a metric of germination, for a period of ten days.

Our results indicate that *A. tuberosa* had the highest overall germination rate after a 10 day vernalization treatment, and consistently yielded the highest percent germination across all vernalization treatments. All species showed improved germination rates after vernalization, but *A. viridis* and *A. asperula* required a minimum 10 days of vernalization for any germination to occur. Additionally, *A. asperula*, *A. speciosa*, and *A. viridis* were on average more susceptible to fungal growth; however, this may stem from contamination at the seed source. We recommend that any further efforts by the government or citizens of Texas take our data into consideration, along with data pertaining to the oviposition preference of the monarchs for each milkweed species when planning milkweed gardens.

Funding Source: Murchison Fellowship, BSURF
Annexins Contribute to Resistance to Ultraviolet Radiation Stress in Leaves but not Roots in Arabidopsis

Nicole Jozefiak*, Dr. James Shinkle

Annexins are a collection of phospholipid-binding proteins found in many organisms, including plants. Annexins are important proteins that help regulate cellular response within a cell’s environment. They also aid in the stabilization of plasma membranes. We used Arabidopsis lines carrying mutations in two annexin genes to investigate if these proteins confer resistance to stress caused by ultraviolet radiation. Two experiments were conducted: the first way is to examine changes in root growth after exposure to UV-B. Arabidopsis seedlings were placed on petri dishes and allowed to grow for four days. A control of each species was immediately rotated 90º and allowed to grow for another three days. The remaining dishes were exposed to UV-B for either 3 minutes, 1 minute, and 18 seconds at 890mWm⁻². Following radiation, they were rotated 90º and allowed to grow for three more days. After the three days, all the plates were imaged and the roots were measure on ImageJ. The roots were measured where a kink formed due to rotation after radiation. We found that the annexin 1-4 mutants showed less root growth when compared to the wild types. However, there was no evidence that the annexin 1-4 mutants had a higher sensitivity to UV-B. The second experiment was conducted in order to see if UV-B had an effect on electrolyte leakage through the leaves of Arabidopsis containing annexin mutations. These plants were exposed to 30 minutes of UV-B at 1.6 kj m⁻² for four days. After the treatment, 20 leaf discs were hole-punched from each plant. Five leaf discs were placed into a single Eppendorf tube, giving us four trials. Each tube was filled with 1 ml of 18 megaohm deionized water. They were then subjected to a cold treatment held at 4 ºC for 3 hours while being shaken gently. After the 3 hour treatment, the conductivity of their solution was measured. Then the discs were removed from their Eppendorf tubes and placed into new tubes so that they could be submerged in liquid nitrogen and exposed to -80ºC for 24 hours. The leaf discs were rehydrated with their original solution and set out to return to room temperature. The conductivity was then again measured and ratios between both conductivity measurements were calculated. We concluded that the annexin 1-4 mutants occasionally have higher readings than the columbia wild-type, but often there is no difference in electrolyte leakage. However, we did find that annexin 1-4 2-1 mutants release 33% more electrolytes than the columbia wild-type.

Funding Source: Ronald E. McNair Post baccalaureate Achievement Program
Developing China’s Wonderland: A Comparison of the First National Parks in China and the United States

Natalie Belew*, Saurav Chhetri, Dr. David Ribble & Dr. Kelly Lyons

At the turn of the century, the People’s Republic of China began developing a national park with goals similar to those of the United States’ national park system. Pudacuo National Park, located in Shangri-La of Yunnan province, is the premiere park in China with its mission of preserving biodiversity. While China has designated hundreds of national parks since 1983, until now, none have met the standards of the UN International Union for the Conservation of Nature. In this project, we ask how the development of this national park as well as the philosophy of park designation and management in China compares to the process taken in the United States to establish our national park system in the late 19th century. Additionally, we seek to understand the cultural, political, and philosophical background of the region and make parallels between current land-use practices and the idealistic Buddhist principles of moderation in James Hilton’s own Shangri-La in *Lost Horizon* (1933). By exploring the available literature in both countries, we conclude many parallels between the foundation of national parks of China and the United States.

Funding Source: Murchison Foundation
The Use of Wharton’s Jelly Derived Mesenchymal Stem Cells in the Field of Neonatology

Yasmeen Alayli*, Caitlyn Winter, Sam Kahlenberg, Lauren Winter, Dr. Alvaro Moreira

Preterm birth is a major US health concern that affects 12% of all deliveries. Many preterm infants are discharged from the hospital with morbidities that lead to an increased risk for neurodevelopmental impairment, recurrent hospitalizations, and life-long conditions. Unfortunately, the treatments of these conditions are palliative rather than curative, which stresses the need for new and innovative strategies. Advances in the field of regenerative medicine have suggested alternate solutions for treating many of these conditions. Specifically, mesenchymal stem cells (MSCs) derived from human umbilical cord Wharton’s jelly (WJ) have shown promising preclinical results in treating adult onset diseases. Unlike bone-marrow and embryonic derived stem cells, WJ-MSCs are easily obtained, have low immunogenicity, and offer the potential for autologous therapy. While there are several studies to uphold the efficacy of WJ-MSCs in adult conditions, there is an unmet need for the investigation of their use in treating neonates. The purpose of this review is to provide a summary of the techniques used to isolate, characterize, and differentiate WJ-MSCs, as well as present examples of their use in treating neonatal diseases.

Funding Source: Institute for Integrated Medicine and Science KL2TR001118-04
How Environment Shapes Blood Physiology in Caribbean Anoles

Miguel A. Webber* & Brittney M. Ivanov, Dr. Michele A. Johnson

Oxygen transport in the blood is critical for all animals, but cold temperatures and high altitudes represent significant challenges to oxygen uptake efficiency in any species. Animals can respond to these challenges by increasing their blood concentration of hemoglobin (the protein responsible for oxygen transport), the relative abundance of red blood cells, which carry oxygen (also called hematocrit), or the size of these cells. However, these effects have only been previously studied within single species. To determine how blood physiology across a group of species responds to compensate for this, we collected males from each of 13 species of anole lizards native to the Dominican Republic. These lizards are ideal for this study because they live across a wide range of habitats across varying altitudes and, as ectotherms, they are particularly sensitive to variation in climate. We measured the concentration of blood hemoglobin, hematocrit, and red blood cell area. We then collected environmental data for each species at the site of capture: elevation, mean temperature, annual precipitation, and net primary productivity (NPP, as a proxy for the rate of oxygen production). Using phylogenetically informed analyses, we determined that species adapt to lower temperatures and lower oxygen availability with increases in hemoglobin and hematocrit. Species occurring at high elevations also exhibited increased hematocrit. These results demonstrate clear evidence of hematological adaptations to hypoxic environments, and show how habitat specialization can provoke significant changes in physiology, even between closely related species.

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The Space Age and Cosmic Connection of Dr. Funkenstein and Sun Ra: Musical Afro-Futuristic Counterculture of the 1950’s-1980’s

Patrick Villalpando*, Dr. Elizabeth Dyer

“I’m playing dark history. It’s beyond black. I’m dealing with the dark things of the cosmos.”- Sun Ra.

As the popularity of futurism grew from the beginning of the nineteenth century, the idea of extraterrestrial life began to become more than just a myth or fantasy. Outer space became a real place that could be reached and used to escape our earthly problems. The term Afro-futurism refers to a literary, cultural, and philosophical style that combines science fiction and historical fiction with African-American culture. This genre was used to express ideas of race, hope, and community by two very prominent American composers, “Dr. Funkenstein,” formerly known as George Clinton, and Le Sony'r Ra, better known as Sun Ra. This paper includes an examination of George Clinton's use of hallucinogens in the 1960’s and how “P-Funk” became more than just a musical genre, while Sun Ra used Egyptian mythology as a musical/visual inspiration in his works and in leading his ensemble to live a “conscious life”. Finally, this paper explores these composers’ similarities and differences in their ideas within the framework of Afro-futurism. Why would these artists use Afro-futurism to express their musical and philosophical ideas? What are the hidden messages in their ideas? Why is Space so funky?

Funding Source: Ronald McNair Program at Our Lady of the Lake University
Reduction of *Escherichia coli* Populations by Probiotic Bacilli in Limiting Nutrient Environments

**Karina J. Bridges**, Dr. Frank Healy

*Escherichia coli* is one of the most common causal agents of hospital associated infections (HAI). A variety of methods have been developed to reduce the incidence of HAIs such as detergents and chemical disinfectants. However because microorganisms can adapt to a variety of environmental and physical conditions, a resistance to extensively used antiseptics and disinfectants has recently been reported. In response to this dilemma, probiotics are also being explored as a method to reduce HAI bacteria in clinical settings. This approach presumably relies on the abilities of probiotic microorganisms to outcompete, inactivate, or kill undesirable bacteria in target environments. Chrisal is a commercially available probiotic formulation that has been reported to significantly reduce populations of pathogenic strains of *E. coli* and other bacteria associated with surfaces in hospitals. Chrisal is a proprietary vehicle containing a mixture of strains of *Bacillus megaterium*, *B. pumilus* and *B. subtilis*, though the mechanism at work in the reduction of microbial numbers is unknown. In order to investigate the roles of these bacilli in the reduction of HAI bacteria, competition assays were performed using different pairwise combinations of bacilli and *E. coli* in liquid media with varying nutrient concentrations and initial population densities to assess whether *E. coli* population reductions were due to specific species of bacilli. Following overnight growth of bacterial co-cultures in the different media and population conditions, samples were plated on nutrient agar to determine final bacterial counts and population sizes. Our results suggest that in limiting nutrient conditions, *E. coli* numbers are reduced when grown in co-culture with strains of *B. pumilus* and *B. subtilis* where the initial populations of bacilli are equal to or higher than that of *E. coli*. No clear effects of *B. megaterium* on *E. coli* were observed in liquid media competition assays when these two organisms were grown together, possibly suggesting that this organism may exert competitive effects in different conditions or against other bacterial species, such as *Staphylococcus aureus*. Given the reported efficacy of probiotic formulations on the reduction of clinically important HAI pathogens, further investigation into probiotic/HAI bacteria interactions will be valuable in revealing the underlying mechanism(s) that cause reductions in bacterial numbers.
True Community Organizing

Hunter Sosby*, Dr. Rosana Blanco-Cano.

The Esperanza Peace and Justice Center’s mission is to be a voice for marginalized communities, especially women, people of color, queer people, the working class and poor. The purpose of this internship was to understand how arts programming can be used as a tool for community activism and organization, and on a broader scale, how to develop a worldview focused on race, class, gender, and sexuality. To accomplish this, this work focused both on community programming and on advocating for the Esperanza’s mission in various responses to City of San Antonio activities and documents. This work also helped identify how connected all social issues are, and how to become an effective ally to various historically marginalized communities.

Funding Source: Arts, Letters, and Enterprise
Examining the relationship between acculturation and assertiveness on Our Lady of the Lake University’s Helping Profession Majors

Juanita Ramos*, Dr. Karina E. Gil.

The present study of 177 students who have selected a Helping Profession (Social Work, Psychology or Counseling) as their major examine the relationship among Personal Attributes, Personal Demographics, Academic Classification, Campus Resources, Family Educational Level, Migration, Assertiveness and Acculturation. Two Surveying Instruments were used: The Simple Rathus Assertiveness Schedule (McCormick, 1984), the Short Acculturation Scale for Hispanics by Marin et Al. (1987) and a researcher created Demographic and Academic Questionnaires. Regression analysis, Analysis of Variance, Multiple Analysis of Variance, Correlations and t-Tests were conducted on the data. Results indicated age, income, religion, academic classification and campus location were significant variables associated with assertiveness. This cross sectional, exploratory study contributes to the body of knowledge by exploring how the aforementioned variables relate to assertiveness in student seeking a degree in a Helping Profession.

Keywords: assertiveness, acculturation, Hispanics, first generation, college and university
Assessing Brain Activity Associated with Emotional Reactivity and Musical Valence and Intensity

Ashley Ford*, Dr. Loranel Graham

This research involves examining multiple variables of emotional reactivity and music valence and intensity to assess brain activity. Emotional reactivity is a person’s response to an external stimulus. These are reactions experienced from events and situations that happen around us. The three elements that make up a complete emotional reaction are sensitivity, intensity and duration, along with physiological changes of the body. This is important because emotional reactivity has been linked with psychopathological conditions like depression. It has been found that extreme levels of reactivity is linked with depression.

Music is known to elicit emotions through tones, rhythms, keys, and intensity. Many people listen to music because of its emotional effect. For example listening to sad music to provoke a sad emotional state or memories of a sad event. Emotions that have been studied with music are the general happiness, sadness, and fear. This is important because these musical emotions have been linked to different patterns of brain activity with the emotional tone of music. For example, happiness has been linked with the stimulation of the striatum and auditory areas in the brain.

Overall, the variables of emotional reactivity along with musical valence and intensity proposes the theme of this research project. The purpose of this research is to determine if there is an effect of emotional reactivity (low vs high) and musical valence (pleasant vs unpleasant) and intensity (calm vs intense) on brain activity.

Funding Source: McNair Scholars Program at Our Lady of the Lake University
Preliminary Characterization of Secondary Metabolites from the WS5995-Producer *Streptomyces acidiscabies*

**Ryan Pu*, Dr. Frank Healy

*Streptomyces* bacteria are morphologically complex and produce different classes of secondary metabolites, for example polyketides and peptides, with a broad spectrum of biological activities, including anticancer, antibacterial and other drugs. It is of interest to understand the assembly of these compounds for a variety of reasons. For example, to aid in the improvement of existing drugs or in the design and synthesis of novel drugs. *Streptomyces acidiscabies* produces the WS5995 aromatic type II polyketides which, while simple angucyclinones, undergo an uncommon oxidative ring cleavage reaction during assembly. Analysis of the organism’s ~11 Mbp genome reveals numerous types of secondary metabolite biosynthetic gene clusters, including one predicted to encode polyketide synthase (PKS) enzymes for the production of type II aromatic polyketide(s). In this study, we report findings from the preliminary analysis of metabolite extracts of wild type *S. acidiscabies* cultures, and derivatives carrying type II PKS pathway and regulatory mutations in order to characterize products and intermediates associated with the gene cluster. Ethyl acetate extracts from culture filtrates of wild type, and flavoenzyme, luciferase and GBL receptor homolog mutants were analyzed using silica gel thin layer chromatography and reverse phase HPLC. Chromatogram data reveal differences in metabolite abundances and profiles between wild type and mutant extracts. A non-polar compound present in high abundance in GBL receptor mutant extracts was purified and analyzed by proton NMR spectroscopy. NMR spectral data were consistent with the compound possessing some structural characteristics of polyketides such as the WS5995 aromatic polyketides, but of insufficient quality to make precise structural assignments. Future efforts will focus on a systematic genetic and biochemical characterization of the pathway and structural elucidation of intermediates and products, and determining whether the pathway encodes components required for WS5995 biosynthesis. If so, our analysis should provide insights into the mechanism underlying the ring cleavage of the WS5995 metabolites.

**Funding Source:** Murchison Research Fellowships
Studying the Catalytic Behavior and Chemical Properties of Gold Nanoparticles

Christine Peterson* & Meagan Pollock*, Dr. Christopher Pursell & Dr. Bert Chandler

Catalysts play an important role in many important chemical reactions. They provide an alternate pathway for reactions to occur, which allows for increased reaction rates and more productive reactions. Our research group studies gold nanoparticle catalysts that are supported on metal oxide supports. The gold nanoparticles and the metal oxide support have close interactions that can influence catalytic behavior.

We have studied hydrogen and carbon monoxide adsorption on these catalysts and observed that both do indeed adsorb on the gold. They produce an unusual infrared phenomenon. This phenomenon was observed using Fourier Transform Infrared (FTIR) spectroscopy and is characterized by a broadband change in the light transmittance of the catalyst. We have performed experiments this summer to better understand this broadband phenomenon.

These results will be discussed during this presentation.

Funding Source: National Science Foundation, Welch Foundation
Synthesis and Evaluation of Reactive Oxygen Species (ROS)-Activatable Prodrugs

Manasa Sarma* & Jonathan Palmer*, Dr. Christina Cooley

Misfolded proteins, protein aggregates and oxidative stress are associated with age-related, neurodegenerative diseases such as Alzheimer’s and Huntington’s. Typically, the cell responds to these stressors by inducing the Heat Shock Response (HSR), which produces an array of chaperones and enzymes that facilitate protein folding and aggregate breakdown. However, the ability to mount the HSR naturally in cells, particularly in neurons, is impaired with age. Previous studies have indicated that Celastrol, a triterpene natural product, and its analogs may treat these diseases through chemical induction of the HSR. However, the blanket and perpetual induction of the HSR by free Celastrol may pose serious health concerns, such as the depletion of cellular resources and the favoring of cancerous conditions.

To address these issues, we synthesized prodrugs of Celastrol and its analogs that will release to free drug in the presence of oxidative stress. We hypothesize that the specific release of the HSR inducer by ROS in disease-afflicted areas will decrease off-target effects and reduce oxidative damage. We will describe the synthesis of various Celastrol analogs and prodrugs, as well as preliminary analysis of their properties in biological conditions.

Funding Source: Welch Foundation, Trinity University
The original ExBox$^{4+}$ 1 structure, developed by Stoddart as a potential sequestering agent for polycyclic aromatic hydrocarbons (PAHs), was modified to produce two hosts with wider tops and bases with benzo(rst)pentaphene 2 and pyrimidine-quinoxaline-pyrimidine 3 replacing the triaryl moiety. We predict that having a wider top and base will result in stronger binding with nonlinear polycyclic aromatic hydrocarbons (PAH) guest molecules due to an increased surface area of interactions. The new hosts and their host-guest complexes of both a linear acene (anthracene), and nonlinear acenes (pyrene and triphenylene) were optimized using DFT (wB97X-D/6-311G(d,p)) in gas and solution phases. The binding energy increased linearly as the size of the guest acenes increased. In both gas and solution phases, the new hosts displayed greater binding enthalpies and free energies with both the linear acene and the nonlinear acenes compared with the original ExBox$^{4+}$ structure.
Cucurbituril-Induced Peptide Folding

Aamuktha Karla*, Dr. Adam Urbach

Cucurbiturils are synthetic host molecules that bind tightly to a wide variety of guests in aqueous solution, including peptides and proteins. These molecules have gained attention for their stability and low toxicity, and research into cucurbiturils has focused on exploring their interactions with other molecules. Based on recent studies with cucurbituril (Q7) and insulin fragments in the gas phase, we designed a series of peptides to test the effects of Q7 on peptide structure and characterized the complexes using circular dichroism and NMR spectroscopy. Recent results of these studies will be described.

Funding Source: National Science Foundation, Trinity University, Welch Foundation
Metal Nanocrystal Synthesis & Characterization

Nico Dwarica*, Dr. Bert Chandler & Dr. Chris Pursell

Solution-phase synthesis allows for the preparation of monodisperse metal nanocrystals, materials with unique electronic, catalytic, and optical properties. These methods yield nanocrystals composed of a metallic core protected by a coordinated monolayer of organic molecules. In this study, the preparation of nickel nanocrystals was achieved by the thermal decomposition of nickel acetylacetonate in the presence of oleylamine and oleic acid. The solution nanoparticles were initially analyzed with UV-Visible spectroscopy. We attempted to tune the properties of Ni NCs by controlling the relative amounts of reagents, as well as the reaction temperature and time. Using preformed colloidal Ni NCs, we attempted to add a thin layer of gold onto the Ni surface using a galvanic displacement reduction process. UV-Visible spectroscopy showed a weak characteristic Au plasmon band around 550 nm, providing evidence for a core-shell bimetallic structure, consisting of a nickel core and a gold shell.

Funding Source: National Science Foundation and Trinity University Murchison Fellowship
Dib1 and its Role in Spliceosome Assembly

Christian Schreib*, Dr. Corina Maeder

The central dogma of molecular biology states that DNA is used as a template to create pre-messenger RNA, which is then used as a template to create proteins. However, some parts of this pre-mRNA are non-protein coding, and thus it must be removed for proper protein production. Pre-mRNA splicing, a molecular process conserved throughout all eukaryotic organisms, removes these non-coding regions of the pre-mRNA. The spliceosome, a large multi-component molecular machine, assembles onto the pre-mRNA and catalyzes the process of pre-mRNA splicing. The spliceosome is made of ~100 proteins. One such protein is Dib1, a small and essential protein which is highly conserved. Previously, two different mutations to Dib1 were found to inhibit splicing and perturb the growth of yeast, our model organism. To further characterize these mutations, we are testing how the assembly of the spliceosome on the pre-mRNA is affected by these Dib1 mutations by native gel analysis. Our current data suggests that these Dib1 mutations stop the spliceosome mid-assembly. Paired with our previous findings, this research will allow us to better elucidate the role of Dib1 in splicing.

Funding Source: Beckman Foundation and Welch Foundation
Investigating the role of deprotonated ligating histidines in $\text{H}^+$ translocation at the CuA site of cytochrome $c$ oxidase

Taylor Devlin*, Dr. Laura Hunsicker-Wang.

The respiratory electron transport chain is the final set of steps in the production of adenosine triphosphate (ATP), the main form of energy used by cells. The final complex in the chain, cytochrome $c$ oxidase, couples electron transfer with pumping protons across the membrane, which creates the chemical gradient that drives the production of ATP. The transferred electrons are then used to reduce molecular oxygen to water. CuA is the initial electron acceptor in cytochrome $c$ oxidase, and it consists of two copper ions bridged by two cysteines and ligated by two histidines, a methionine, and the carbonyl backbone of a nearby glutamine. The two ligating histidines are of particular interest as they may affect the ability of the center to accept electrons and may be involved in the movement of protons through cytochrome $c$ oxidase, depending on their protonation state. To test for the presence of deprotonated ligating histidines, the portion of cytochrome $c$ oxidase from the bacteria *Thermus thermophilus* that contains the CuA site (the CuA protein) was reacted with the chemical modifier diethyl pyrocarbonate and observed through UV-visible and circular dichroism spectroscopies at pH 5.0-9.0. The mutant protein with the non-ligating histidines removed (H40A/H117A) was similarly tested. Results from both proteins indicate that diethyl pyrocarbonate reacts with one ligating histidine in pH conditions close to those expected in the cell. The existence of the deprotonated ligating histidine indicates that this residue could play a role in a proton pumping pathway.

Funding Source: Beckman Foundation, Semmes Distinguished Scholar in Science Award
Characterization of Natural and Heated Ambers by NMR Spectroscopy

Tam M. Nguyen*, Dr. Joseph B. Lambert

Plants secret exudates in response to injury or disease, and to protect themselves from fungi and insects. These secretions, initially liquids, harden to become solids on plants’ surfaces and are fossilized through millions of years to become ambers. If the fossilization process occurs in only a few thousand to a million years, the resin formed is a copal. Natural amber and copal samples from different botanical and geographical sources are characterized using nuclear magnetic resonance (NMR) spectroscopy. Two types of spectra were taken for this study, the standard 1D ¹H (proton) and the 2D COSY (COrrellation SpectroscopY) spectra. Besides classifying these samples into established groups (A-E), NMR spectra can also be used to derive the degree of maturity of the samples, as amber often has broader, less defined peaks compared with copal, which has sharper peaks. With this aspect, several amber and copal samples were heated to examine the effects of heating on the samples’ structure. It is observed that heating produces broader peaks in proton spectra that resemble those of highly matured resins. This happens because elevated temperature may accelerate the cross-linkage reactions between chains of hydrocarbons, which take millions of years to occur naturally. Proton NMR analysis of the heating samples shows evident changes between untreated and heated samples.

Funding Source: The Camille and Henry Dreyfus Foundation
Synthetic Receptors and Peptide Flexibility

Elena Boms*, Dr. Adam R. Urbach

Synthetic receptors can provide a means to model biological interactions that has the advantages of being well-defined structurally, being amenable to spectroscopic characterization, and targeting small, well-defined sites. Cucurbituril is particularly suitable for studying interactions with peptides. To explore how conformational freedom of peptides influences the binding of synthetic receptors, we designed a series of peptides as models for natural systems. The peptides were synthesized using solid-phase synthesis and purified chromatographically. Recent binding studies with cucurbituril will be discussed.

Funding Sources: The Welch Foundation, Trinity University, National Science Foundation
Kinetic Studies of H₂ Oxidation to Understand the Role of Water in PROx

Todd Whittaker*, Dr. Bert Chandler

H₂ production is an important industrial process, as 10 million tons are produced annually in the United States alone. Over half of this hydrogen is used to make ammonia, which is subsequently used to make nitrate fertilizers. CO methanation is the predominant purification technique for H₂; however, this process leaves room for improvement given that up to ~10% of H₂ is lost in methanation. The preferential oxidation of CO (PROx) could replace methanation if a suitable catalyst system could be found. Supported Au nanoparticles are good candidates because they are excellent CO oxidation catalysts and poor hydrogenation catalysts; however, they are not well enough understood to be industrially viable. In a recently proposed mechanism, we show that water is a co-catalyst for CO oxidation. In this study, we further investigate the role of water in PROx. Our results show that, in addition to promoting CO oxidation, water inhibits H₂ oxidation. This is ideal for the PROx reaction, because it means that under high water coverage the CO oxidation reaction is promoted while the H₂ oxidation reaction is inhibited. This should help with further improving the conditions for PROx as an industrially viable reaction.

Funding Source: National Science Foundation & Trinity University (Murchison Fellowship)
Searching for a Möbius Conformation of Cyclometaphenylene

Skylar Cho*, Dr. Steve Bachrach

The plausibility of Möbius strip was explored with various sizes of the macrocycle cyclometaphenylene (CMP) 1 using density functional theory. In order to compare how competitive the Möbius structure will be in terms of energy, the most stable structures of cyclometaphenynes were thoroughly investigated. Möbius conformations are observed in [12]-, [13]-, and [14]-CMP. Conformations of the CMPs are defined by the dihedral angles between adjacent phenyl rings. Patterns in the distribution of the values of these dihedral angles are being explored.
Exploring the Importance of the C-terminal tail of a Small Essential Protein Dib1 in Pre-messenger RNA Splicing

Danyal Tahseen*, Dr. Corina Maeder

The successful removal of non-coding introns from pre-mRNA to produce a mature mRNA transcript is dependent on the spliceosome. The spliceosome is a complex of five major snRNAs and over 100 proteins. Of those components, this study focuses on the small and highly conserved protein Dib1, centrally located in the U4/U6.U5 tri-snRNP. Given its location between the pre-mRNA substrate and the U5 snRNA loop 1, Dib1’s apparent absence after catalytic activation evinces its potential importance in allowing the binding of those two partners, and subsequent formation of the spliceosomal complex B*. Based on previous work, Dib1 exhibits the ability to auto-cleave its C-terminal tail region spanning the last 14 residues. This example of proteolytic cleavage is unusual since the protease targets itself and does not abide by typical catalytic mechanisms. However, the connection between this auto-cleavage activity and splicing has not been explored. Our study aims to examine whether this tail region of Dib1 may be part of a regulatory mechanism. Our approach is to conduct PCR mutagenesis on bacterial expression and yeast expression plasmids to generate mutated Dib1 proteins that either lack the C-terminal tail or are unable to auto-cleave it off. The next part of our approach is to purify these proteins to determine whether they still possess the ability to cleave themselves. We will present our progress on this work.

Funding Source: San Antonio Area Foundation
Fluorogenic Polymerization Reactions in Aqueous Media for the Detection of Disease

Zachary Allen* & Jemima Sackey-Addo*, Dr. Christina Cooley

The demand for diagnostic assays around the world has increased rapidly since humans have begun to understand diseases on a molecular level. Several well-tested methods already exist that not only detect analytes but also amplify their signals; a necessary component of any system designed to detect disease at its earliest onset. Although methods such as Polymerase Chain Reactions (PCR) and Enzyme-Linked Immuno-Sorbent Assays (ELISA) have been used for many years with much success, they are not without drawbacks. The machinery, materials, and labor can be extremely expensive, specialized, and inaccessible in certain parts of the world.

Rapid detection of disease without the need for expensive and sophisticated equipment would have a multitude of applications. Using fluorogenic polymerization amplification, we propose a quantifiable, sensitive, and relatively inexpensive strategy for detecting antigen in aqueous media. In order to advance these diagnostic assays, the development of a robust, controlled fluorogenic polymerization reaction in aqueous media is required. The synthesis of select monomers and their application to fluorogenic polymerization reactions in aqueous media will be described.

Funding Source: Welch Foundation, Trinity University, Murchison Undergraduate Research Fellowship
Changes in Reduction Potential of the [2Fe-2S] Cluster of the Rieske Protein Using Multiple Non-Covalent Interactions

Rachel Shepherd*, Dr. Laura Hunsicker Wang

The goal of this research is to determine the effects of various mutations on the reduction potential of Thermus thermophilus Rieske protein (TtRp). TtRp is a protein that contains a two iron two sulfur cluster and is located in complex III of the electron transport chain. The protein acts as a catalyst in the oxidation of quinol and subsequent reduction of cytochrome c allowing electrons to flow through the ETC and protons to be pumped across the inner mitochondrial membrane. The mutations that are studied fall into two categories; they are mutants that affect the number of hydrogen bonds bound to the cluster and those that supply a charged body next to the cluster. When combined, these mutations have been shown to have largely additive effects, with the L135E and Y158F single mutants having reduction potential effects of +8 and -62 mV respectively and the double mutant combination having a reduction potential change of -56 mV. The L135R and G156 double mutants have similar effects with the single mutants having reduction potential changes of +30 and +54 and the double mutant having a change of +81 mV. These proteins have also been characterized using chemical modification of diethyl pyrocarbonate, X-Ray crystallography and electron paramagnetic resonance.

Funding Source: San Antonio Area Foundation
Nitrogen-Substituted Dienes in the Diels-Alder Reaction

Zeina Zayat*, Dr. Steven Bachrach

The Diels-Alder reaction involves the cycloaddition of a diene and dienophile. For the reaction to proceed, the diene should be cis-planar. Dienes like biphenyl are not planar due to the $o$-$o'$-hydrogen interactions. This increases the activation energy of this reaction since the molecule must become planar for the reaction to proceed. Nitrogen substitution into the ortho position will eliminate the $o$-$o'$ interaction, which should lead to a lower activation barrier for the Diels-Alder reaction. We present the DA reactions of ethane or ethyne with a series of nitrogen-substituted bisaryls computed using density functional theory (ωB97X-D/6-311+G(d,p)) in the gas phase.

Funding Source: Welch Foundation and Trinity University
Effects of Neighboring Sequence Context on Cucurbituril-Peptide Interactions

Emily F. Babcock* & Zoheb Hirani, Dr. Adam R. Urbach

Recognizing peptides and proteins with high affinity and selectivity is a challenge in medicine and biotechnology. While both of these criteria have been met and understood for binding at the N-terminus of a polypeptide, relatively little is understood about non-terminal interactions. We designed a peptide library to study the effects of neighboring residues upon the binding of cucurbituril and cucurbituril. This library was synthesized by parallel solid-phase synthesis, characterized by mass spectrometry, high-performance liquid chromatography, and UV spectroscopy. Receptor binding was studied using a parallel fluorescence assay. Recent results will be discussed.

Funding Sources: National Science Foundation, The Welch Foundation, Camille and Henry Dreyfus Foundation, Trinity University
Steric Effects on the Configuration of the Nitrogen in Piperidine

Truongan V. Nguyen*, Dr. Joseph B. Lambert

Conformational analysis has been discussed predominantly through repulsive interactions between non-bonded groups. These analyses have often dealt with the discussion of steric effects between these groups. In piperidine, the configuration of the lone pair and proton on the nitrogen has been studied through this repulsive interaction. More recently, it has been acknowledged that there is an attractive interaction that can have a major influence in determining the equilibrium constants of systems similar to piperidine. The piperidine system has a single proton on the nitrogen that is expected to prefer the axial conformation, which has been tested through conformational calculations. Now, through nuclear magnetic resonance spectroscopy, we have sought evidence that the N proton qualitatively prefers the axial conformation, as seen through its large vicinal coupling constant. However, for piperidine specifically, this result has not yet been achieved due to a presumed proton exchange. To study the conformational preference in piperidine more closely, we look to a derivative, 3,3-dimethylpiperidine. This molecule allows us to study the interactions between an axial 3-methyl group with the hydrogen and the lone pair on nitrogen. If the NH and the CH interactions in the parent piperidine are indeed attractive, the presence of a methyl group would push the NH to its equatorial position. If the lone pair possesses a steric effect, then the lone pair-hydrogen interaction would drive the equilibrium to the NH axial conformation. But first, the synthesis of 3,3-dimethylpiperidine needs to be considered. The results of the synthesis are discussed.

Funding Source: Murchison Undergraduate Fellowship Award
Expanded ExBox$^{4+}$ Analogue Binding Multiple Guest

Nick Morrison*, Dr. Steve Bachrach

The original ExBox$^{4+}$ macromolecule binds a variety of polycyclic aromatic hydrocarbons (PAHs). Expanding the width of the original ExBox$^{4+}$ host by one additional phenyl ring I should provide a cavity in which two PAH molecules can stack on top of each other. We evaluated the binding energy of one or two guests molecules, such as anthracene, tetracene, 1,4-anthraquinone, and 1,4-diaminoanthracene using Density Functional Theory (ωb97XD/6-31G(d)).

Funding Source: Welch Foundation, Trinity University
Exploring Sequence Effects in Cucurbituril-Peptide Interactions

Zoheb Hirani* & Emily F. Babcock, Dr. Adam R. Urbach

Analyzing the specificity of host-guest interactions is crucial to understanding the chemical nature of living systems. Building on recent studies of cucurbituril-peptide interactions in aqueous solution, we designed a library of tripeptides with aromatic, hydrophobic, and basic residues. The library was synthesized by parallel solid-phase synthesis, and characterized by mass spectrometry, high performance liquid chromatography, and UV spectroscopy. Binding to cucurbiturils was measured using a parallel fluorescence assay. The results revealed interesting trends in binding as a function of the peptide sequence. A comprehensive discussion of the results will be presented.

Funding Sources: National Science Foundation, The Welch Foundation, Camille and Henry Dreyfus Foundation, Trinity University
The Role of Water in the Selective Oxidation of Benzyl Alcohol Over Gold Nanoparticle Supported Catalysts

Mariel Santos* & Annette Tombo*, Dr. Bert Chandler & Dr. Chris Pursell

The primary interest of this study was to investigate the role of water in benzyl alcohol oxidation over supported gold nanoparticle catalysts. Differences in reactivity were studied with Michaelis-Menten analyses of the different catalysts. In particular, parameters such as the concentration of benzyl alcohol and reaction temperature were varied to determine the kinetic properties associated with the catalysts. In order to investigate the reaction’s dependence on water, a series of drying studies were conducted by flowing N₂ over the catalyst at several temperatures. Drying the catalyst decreased the reaction rate for both Au/TiO₂ and Au/Al₂O₃ catalysts. Drying the catalyst also increased the Michaelis-Menten parameter $K_R$, and decreased $v_{\text{max}}$. These findings supported the idea that water plays a role in the reaction mechanism, primarily functioning as a base to deprotonate the alcohol and shuttling protons to and from the active sites associated with the Au nanoparticles.

Funding Source: Petroleum Research Fund, National Science Foundation
High Affinity, Reversible Complexes

Jordan Koeller*, Dr. Adam R. Urbach

Divalent host-guest interactions involve two simultaneous binding sites and can form highly stable complexes that can be readily dissociated using a monovalent guest. Several groups have attempted to use this type of multivalent binding to develop high-affinity, reversible complexes, but often the potential gain in stability due to multivalency is mitigated by a loss in conformational entropy in the linker. To explore this issue further, we prepared mono- and divalent guests that are unlabeled and fluorescently labeled using solid-phase synthesis and chromatographic purification. Recent binding studies will be described.

Funding Source: National Science Foundation, Welch Foundation, Trinity University
Support effects on Hydrogenation of Metal Oxide Supported Catalysts

Alexander Hüther*, Daniel Elizondo*, & Heidi Krause*, Dr. Bert Chandler

Gold nanoparticle catalysts have been found to have high selectivity in hydrogenation reactions, making them potentially useful for industrial reactions; however, these catalysts do not have high reactivity. Factors that affect the reactivity include support effects, electronic differences in the metal particles, and number of active sites on the catalyst. Various metal oxide supports were synthesized and their influence on hydrogenation reaction rates determined. These different catalysts were used to selectively hydrogenate 1-Hexyne and Phenylacetylene. Furthermore, Hammett studies were conducted in order to evaluate how the support affects the degree of charge transfer in the rate determining step. A positive rho value was found, which indicates a buildup of negative charge on the organic molecule, and is consistent with hydride transfer to the alkyne being the rate determining step.

Funding Source: National Science Foundation, Petroleum Research Fund, and Welch Foundation, and Trinity Murchison Fellowship
Chiral Selectivity of Organic Superbases

CJ Guzman*, Dr. Steven Bachrach

Organic superbases are defined as any organic base with a higher basicity than dimethylaminonaphthalene (DMAN, or “proton sponge”). These superbases have increased basicity due to an extended hydrogen bond network that occurs between the amino groups present in the molecule, helping stabilize the positive charge that occurs when the base accepts a proton. This study explores the possibility of a chiral organic superbase highly favoring deprotonation of a pro-R or pro-S proton so as to avoid a racemic mixture of product. This chiral selectivity was observed through transition-state optimizations of the acid-base reactions at PBE1PBE/6-31G(d).

Funding Source: Welch Foundation, Trinity University
Binding of Protein Derivatives to Cucurbituril

Amy Grice*, Dr. Adam R. Urbach

Recognition of proteins and organic compounds drive the current understanding of cell-cell interactions, hormone signaling, and other molecular communication processes. Strong binding complexes between a protein and a synthetic receptor could have significant potential for applications in diagnostics, therapeutics, and separations. Building on recent studies with protein-cucurbituril complexes, two protein derivatives were generated containing an aromatic N-terminus. The synthesis of these derivatives, and their biophysical characterization will be described.

Funding Source: National Science Foundation, The Welch Foundation, and Trinity University
Exploring the Effect of Distal Charges on the Reduction Potential of the Rieske Protein from *Thermus thermophilus*

Janett Muñoz* & Mary Hogsett, Dr. Laura Hunsicker-Wang

The Rieske Protein is characterized by a [2Fe-2S] cluster that is ligated by two histidines (His154 and His134) and two cysteines (Cys151 and Cys132). The Rieske Protein is a subunit in complex III of the Electron Transport Chain (ETC) that helps shuttle electrons. Therefore, understanding its reduction potential is an important part of understanding the overall mechanism of the ETC. In the literature, reduction potential differences in Rieske have been proposed to be due to hydrogen bonding to the cluster and ligands as well as accessibility of the solvent and proximity of charged residues to the [2Fe-2S] cluster. A new hypothesis poses that changes to charges on distal residues to the cluster will affect the reduction potential. To probe this hypothesis, a series of mutants have been produced in the Rieske protein from *Thermus thermophilus*. These mutants are grouped into two categories. First, mutants that remove positively charged residues (Arg or Lys) and replace them with neutral or negatively charged residues, have been produced. These changes result in a protein that is overall more negative. The outcome of these mutations are proteins with reduction potentials that are lower, and also point to an effect of distance from the cluster. The second group of mutants remove negatively charged amino acids (Glu and Asp) and replace them with either neutral or positive amino acids. These mutations are being created and cause the protein to be overall more positively charged, which is hypothesized to cause an increase in the reduction potential. All of these mutants are being characterized by measuring the reduction potential, determining the pKa and pi values for the protein, and reacting the protein with diethyl pyrocarbonate.

Funding Source: Ronald E. McNair Postbaccalaureate Achievement Program & San Antonio Area Foundation
Effects of 3-D Microenvironment and Mechanical Properties on the Neuronal Phenotype of HT22 Cells

Rachel Tchen*, Rodrigo Zurita, & Zach Nickle, Dr. Andrea Carolina Jimenez-Vergara, Dr. Dany J. Munoz-Pinto

Matrix stiffness and changes in cell microenvironment from 2D to 3D contexts are shown to be powerful factors modulating cell behavior. Although these two factors have been extensively investigated on mesoderm descending lineages, their effects on nerve cells are not fully understood. In this work, we built bioinspired microenvironments with variable stiffness to support the growth and phenotype expression of neuron-like cells in 2D and 3D contexts. Toward this end, the cholinergic neural cell line, HT22, was used as a cell model. An interpenetrating network (IPN) biomaterial comprised of type I collagen and Poly(ethylene glycol) diacrylate (PEGDA) of 3.4kDa and 6.0 kDa. The PEGDA at different molecular weights and concentrations provided the versatility to control the mechanical stiffness to achieve an elastic modulus of about 1kPa, which is close to native brain tissue.

For encapsulated cells, we measured circularity within the IPN as well as cell viability 48 hours following encapsulation. Furthermore, we evaluated phenotypic changes of the HT22 cells between 2D and 3D microenvironments using two different moduli by quantifying gene expression levels. The genes assessed included general neural markers (β III Tubulin, Microtubule Associated Protein 2, Neuronal PAS Domain Protein 4, and Neural Cell Adhesion Molecule 1) as well as markers specific to cholinergic neurons (Vesicular Acetylcholine Transporter and Cholinergic Muscarinic Receptor 2). With this work, we aim to develop a primary in vitro 3D model that can be used in the study of neurological disorders such as Alzheimer’s disease.


Funding Sources: Murchison Summer Undergraduate Research Fellowship, Department of Engineering Science
Lipid Analysis of Astrocyte Secretions: Change as a Function of Age

Cynthia Alvarez*, Dr. James Roberts

Astrocytes are a major type of glial cell that are responsible for the general upkeep of surrounding neurons. They secrete apolipoproteins, which bind lipids that are involved in the basic function of a neuron and serve as a protection against oxidative stress mediated neurodegenerative diseases. Some of the most notable apolipoproteins include apoE and apoA1, which are associated with neurodegenerative illnesses such as Alzheimer’s disease. We aimed to evaluate the composition of astrocyte secretions at different ages of astrocytes (4 and 28 month) to see if there a change in their protective effects on neurons is reflected. The cells were placed in serum free growth medium and it was collected after 3 days. Media purification was done by precipitation with Dextran Sulfate (Cell Biolabs) to separate and concentrate the low-density lipoproteins/ very low-density lipoproteins (LDLs/VLDLs) from the high-density lipoproteins (HDLs) and analyzing the protein concentration from each sample. Cleanascite (Biotech Support Group), a lipid binding resin, was used in a different form of media purification that yielded total lipid content. Western Blots were then used to analyze the protein content from the different lipoproteins from both samples. The lipid content from the media is being quantitatively evaluated using thin layer chromatography and mass spectrometry. It is anticipated that the amount of released lipids will decrease or change in content with age, thereby decreasing the astrocytes’ protective effects on neurons against neurodegenerative diseases, which will be seen by the degree of deterioration of the neurons.

Funding Source: Megabucks Foundation, Ronald E. McNair Postbaccalaureate Achievement Program, & Cowles Professorship
Time-Correlated Single-Photon Counting (TCSPC)
Fluorescence Imaging of Lipid Domains In Raft-
Mimicking Giant Unilamellar Vesicles (GUV’s)

James Clarke*, Dr. Kwan Kelvin Cheng

We have designed and constructed a high-throughput electrofusion chamber and an incubator to fabricate GUV’s of different ternary compositions consisting of high-melting lipids, low-melting lipids, cholesterol and both ordered and disordered phase sensitive fluorescent probes (DiC12, and BODIPY-CHOL). During the three-part GUV electrofusion process multiple pulse sequences, with amplitudes ranging from 50mVpp to 2.2Vpp and frequencies from 10Hz down to 5Hz, were used. Both traditional intensity based confocal imaging and TCSPC Fluorescence Lifetime Imaging (FLIM) techniques were used to characterize phase separated lipid domains in GUV’s. With traditional confocal imaging you see the combination of both probe concentration and the chemical environment. The TCSPC technique allows us to specifically look at the chemical environment of the fluorescence probes. These techniques will be applied to future protein/lipid-raft interactions in lipid membranes and live cells.

Funding Source: Murchison Fellowship
Biochemical characterization of spliceosomal protein
Dib1 mutants

Fahad Zaman* & Camille Potts, Dr. Corina Maeder

The spliceosome is a large molecular machine that facilitates RNA splicing, the removal of introns (non-coding RNA) and ligation of exons (coding RNA) to produce mature messenger RNA. Dib1 is a small, central, essential protein in the spliceosome of *Saccharomyces cerevisiae* that is conserved from yeast to humans. A potential role of Dib1 is to control spliceosome activation, and upon its departure, the chemical steps of splicing begin. Previous work in the lab on *S. cerevisiae* identified two temperature sensitive Dib1 mutants that are defective in splicing. We have performed biochemical characterization of these mutants using circular dichroism spectroscopy in order to gain insight into the structure and function of Dib1.

Funding Source: San Antonio Area Foundation and Trinity University
Evaluation of the Potential of Collagen-PEGDA Interpenetrating Networks for Nerve Tissue Engineering Using hMSCs

Rodrigo Zurita*, Zach Nickle*, & Rachel Tchen, Dr. Andrea Carolina Jimenez-Vergara & Dr. Dany J. Munoz-Pinto

Human mesenchymal stem cells (hMSCs) are multipotent cells, which can differentiate into chondrogenic, osteogenic, adipogenic or neurogenic cell lineages. In this work, we evaluated the potential of a double hydrogel network structure comprised of Type I Collagen and Poly(ethylene glycol) Diacrylate (PEGDA) to promote and support the differentiation of hMSCs into neuron-like cells. This versatile hydrogel platform allows for the control of the degree of cell spreading in a 3D context and the tailoring of the hydrogel stiffness and bioactivity. The mechanical performance of this platform can be adjusted to target a broad range of mechanical properties that simulate the physiological stiffness of brain, spinal cord, or peripheral nerve tissue. The phenotype progression of hMSCs was examined at the gene and protein expression level in terms of the differentiation markers Neuronal Specific Nuclei Protein (NeuN), Neuron Specific Enolase (NSE), Microtubule Associated Protein 2 (MAP2), Glial Acidic Fibrillary Protein (GFAP), Beta 3 Tubulin, Nestin, SRY-Box-2 (SOX2), and Galactocerebroside (GalC) in the absence and presence of soluble differentiation factors.

Funding Source: Trinity University Department of Engineering Science
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