ABSTRACTS

Title; Using Silver Nanoparticles to Detect Early Onset of Disease

Author: Porter Wilkes, Payton Riggs, Jonah Babbel, Camden Cox, Gabriel Romney,

Mentor: Dr. Christopher Monson

Abstract
Silver nanoparticles are of interest because of their chemical, antimicrobial, and other properties. Through a nanoparticle fabrication method, we can consistently form high concentrations of nanoparticles of the same size and shape using common reagents for silver nanoparticle fabrication (silver nitrate, sodium hydroxide, ascorbic acid, and a specific capping ligand, which coats the outside of the nanoparticle, determining its final size and shape). Specifically, we have compared a lipid (1,2-dioleoyl-sn-glycero-3-phospho-L-serine), a vitamin (vitamin B), and several proteins (BSA, Casein, and IgG) and have observed differences in the nanoparticles produced when using these capping ligands. We can identify these differences by examining the nanoparticles' abilities to fluoresce using fluorescence spectroscopy. We observed that nanoparticles made from the distinct proteins fluoresced differently. We have examined the effects of diluting the concentration of nanoparticles and have found that as the nanoparticle solution is progressively diluted, the fluorescence spectra shows a trend of blue-shifting/increase in intensity, followed by stabilizing at approximately λ=460nm / decrease in intensity. We have also examined the nanoparticles formed from mixtures of ligands and have observed that these nanoparticles fluoresce differently than nanoparticles formed from each of the pure capping ligands. Our objective is to identify distinguishing features between the fluorescence of nanoparticles fabricated using different biological samples as capping ligands, with the vision that this research could lead to new methods of identifying diseases at early stages by comparing the fluorescence of nanoparticles created from samples of subjects believed to have a disease to those who do not.

Title: What's in your water?

Author: Cameron Stokes, Brayden Bailey

Mentor: Dr. Chris Monson

Abstract:
The concentration of dissolved oxygen in aqueous environments is relevant in both biological and chemical processes. Low oxygen environments occur in natural and controlled waters, and variations in oxygen levels may critically change metabolic and other chemical pathways. We previously developed a microfluidic device modeled after the STOx electrode to measure dissolved oxygen. The STOx electrode is the most sensitive electrochemical device available right now for the quantitation of oxygen. However, it is fragile and expensive whereas our device is constructed from PDMS and is thus more rugged and inexpensive to produce. Following the previous device, we have created a new device that includes only three electrodes instead of eight, a 3D printed capsule to simplify the design, and the ability to control the flow of fluid in order to still perform high-sensitivity measurements with three electrodes. We hope that this device will improve the data that was previously collected and provide a resource to give people the ability to measure oxygen

concentrations in aqueous environments in a simple, inexpensive way.

Title: Mercury For Dinner? Aqueous Heavy Metal Sequestration

Author: Jacob Kjeldahl Jensen, Chris Monson

Mentor: Chris Monson

Abstract:
Heavy metals threaten the aquatic life and are a danger to human health. Multiple sites are reporting an increase in heavy metal concentration. Through a three-step process – pumping, filtration, and removal – it is possible to responsibly remove the toxic metals. A pumping device will provide a microfluidic, filtration device with a continuous flow of solution. The filtration device will separate out a high concentration, metal ion solution using an electric field. The solution will then move on to the removal phase. Using a charged gold mesh and herringbone passive mixing, the metal ions will reduce and form a solid which can be removed and disposed of in an environmentally responsible manner.

Title: Changing the Paradigm on Copper Nanoparticle Formation

Author: Tanner Stenlund, Jacob Olvera, Jessie Fischer Stenlund

Mentor: Chris Monson

Abstract:
Copper nanoparticles have a variety of uses and applications in many different fields. Current fabrication methods start with copper ions and build them up to the desired nanoparticle size. We developed a new way to synthesize copper nanoparticles starting with a sheet of solid copper and sonicating it in hydrochloric acid. While copper is a relatively unreactive metal and isn't known to react with HCl, this method has been found to break down solid copper into nanoparticles in a predictable fashion. Using UV-Vis and fluorescence analysis as well as atomic force microscopy, we were able to determine that nanoparticles are being created and that the concentration of HCl affects their formation. Additionally, these nanoparticles are stable over long periods of time, unlike traditionally fabricated nanoparticles which tend to decompose relatively quickly. Furthermore, preliminary data suggests that the nanoparticles may be able to catalyze the formation of additional nanoparticles under certain conditions. We are currently further exploring the properties and fabrication of these nanoparticles.

Title: Making Membranes: Analyzing Supported Hybrid Lipid-Polymer Bilayer Formation

Author: Jessie Fischer, Dr. Wally Paxton, Keith Willes, Dr. Wally Paxton

Mentor: Dr. Wally Paxton,Dr Chris Monson

Abstract:
Biosensing is one of the many applications of supported hybrid lipid-polymer bilayers (SHBs) that are currently being explored. SHBs are formed by introducing a hybrid vesicle to solid supports,

including glass and other silicon-based materials. It is hypothesized that the vesicle-glass interactions can be controlled by altering the charges present on the vesicles and the pH of the vesicle solution. To test this, several vesicle solutions were prepared using varying charge compositions, both positive and negative. Many of these solutions were diluted into different pH buffers ranging from pH 2-12. Dynamic light scattering was used to measure vesicle charge and a Quartz Crystal Microbalance with Dissipation was used to measure vesicle interactions with the solid support. The results showed that positively charged vesicles formed bilayers at both neutral and high pH. Negatively charged vesicles did not form bilayers at neutral pH—as expected—but did, however, form bilayers at low pH. Thus, the experiments conducted were able to determine that SHBs can form in a wide range of pH solutions and that altering the charge on the polymers will affect the formation of the bilayers. This work has valuable implications in the case of biosensing because these bilayers may allow biosensors to operate in a wider range of environments, including more extreme acidic or basic solutions.

Title: Prevalence of Nutritional Supplement Use and Early Indicators of Renal Dysfunction Among

Collegiate Athletes

Author: Brayden Koch, Jason Hailes Alexa Lord

Mentor: Mary Jo Tufte, Paul Pillitteri

Abstract:
Nutritional supplements are commonly used by collegiate athletes to improve their training and performance. Given the great variety of supplements and their benefits, many athletes consume multiple different supplements during their competitive season. These supplements, along with a vigorous training regimen, have the potential to put added stress on the kidneys, which can be measured using an athlete's albumin-to-creatinine ratio (ACR). Albumin, a natural protein in the blood responsible for maintaining osmotic pressure, along with creatinine, a byproduct of muscle metabolism, are normally found in the urine at a ratio of 30 mg/g could suggest renal dysfunction in the subject. To understand the lifestyle choices of each athlete, each participant will complete a survey representing their individual supplement and exercise habits. A urine sample will be taken from each participant and analyzed to determine their ACR. Data will be analyzed to identify the potential correlation between lifestyle and renal health from the participants. From this study, we hope to better understand possible protein-induced renal dysfunction in athletes and demonstrate possible connections between protein supplements, exercise, and kidney function to help improve the health of today's athletes.

Title: Live Data Implementation for Water Systems/ Service Management

Author: Steven Bodine

Mentor: David Maxwell

Abstract:
Currently most water management systems are manually checked and recorded which takes a large amount of man hours and time. I have found that this process can potentially be automated through

the use of smart gateways and wireless data transmitters attached to sensors within the water system at certain points. Automating this process also leads the the available implementation of live data feeds which unlocks the potential for very detailed analysis of the water system and preventative maintenance. The installation of live data feed sensors within the water system, and the implementation of the data throughout the GIS software-space significantly enhances the efficiency of the water management company as it provides them with quick accurate data regarding malfunctions, system failures, active use data, historical data, and other information that is critical for analysis and upgrade to the overall system. The live data sensors are installed at pressure reducing stations - the gateway between the water storage tanks, and the household. Resulting from that the sensors are distributed throughout the system and result in a blanket coverage over the whole system. The sensors are being used to track all data pertaining to usage, failures, maintenance needs, and pressure regulation. The implementation of this technology is a step forward in the world of water management and inevitably makes the whole system function more effectively by reducing loss and misused water.

Title: Recent Geology Research Projects

Author: Grant Shimer, Jonathan Ginouves, Kade Jackson, Addie Rich, Jessica Robinson

Abstract:
Student research projects are a foundational component of the Geology and Geosciences degrees at SUU. Students typically begin faculty-mentored research three or four semesters before graduation. Some students join existing projects, but many work with their faculty mentor to create custom projects designed to provide the student with research experiences oriented towards their geoscience career of interest. We highlight four ongoing student research projects that include field and laboratory experiences in a variety of geoscience disciplines, including paleontology, sedimentology, stratigraphy, geochemistry, geologic hazards, and geographic information systems. The projects are examples of some of the unique career-focused opportunities students get at SUU and in the Geosciences department.

Title: Students' Perceptions of Choice-based Assessment: A Case Study

Author: Jamie Spinney, Suzanne Kerr

Abstract:
The traditional teacher-centered approach meant that teachers have been in total control of how and when students' learning has been assessed. Alternatively, a learner-centered approach based on choice-based assessment gives students a voice by allowing them to choose how, and to some extent when, their learning is assessed. An observational study was designed to expose undergraduate students, and subsequently measured their receptiveness, to a choice-based assessment strategy. A total of 67 students voluntarily shared their perceptions on choice-based assessment over a three-semester sampling period (spring 2017, fall 2017, and fall 2018) with an overall response rate of 79%. Results from this case study demonstrate that most students expressed strong support for choice-based assessment; the strategy enhanced students' engagement and satisfaction, it allowed them to take control of their learning, and it let them focus on their strengths and interests. However, choice was not motivating for all students; a small percentage of students expressed concerns over the potential for procrastination, which may have been a symptom of the design of the assessment strategy, too many choices, and/or a lack of experience with choice. Overall, the results

of this study clearly indicate that students were highly receptive to having a voice in their learning, which provides further evidence of the untapped potential for choice-based assessment strategies to foster student engagement, improve student satisfaction, and better prepare students to actively participate in their learning.

Title: From Abled to Disabled: How to Enable Those Around Us

Author: Brittany Warner

Mentor: Susan Hunter

Abstract:
Disabilities often come with extreme stereotypes, causing reluctancy in many to admit when they may need help. Even though 26% of all adults in the United States have some type of registered disability (CDC, 2020). Type 1 Diabetes (T1D) is one of these disabilities. With many stereotypes and misunderstandings that cause many Type 1 Diabetics to feel they need to hide their medical condition. This research utilizes personal experience as a Type 1 Diabetic and professional studies to explore the visible and invisible challenges experienced in the life of a person who is 'abled' versus one who is 'disabled'. The purpose of this research is to explore options to help enable those around us. Though utilizing mainly the experience of Type 1 Diabetes, a physical disability, this research can apply to help enable all who live with a disability.

Title: Search for paraoxon-degrading bacteria from soil samples

Author: Connor Noland, Mohan Wang, Ashlee Chynoweth, Randon Olsen

Mentor: Dr. Roger Gold

Abstract:
Organophosphorous pesticides, including paraoxon and malathion, are commonly used to control agricultural pests; related compounds have been used as chemical warfare agents in times of war and in terroristic attacks. Since the Tokyo subway sarin attack in 1995, governments have been seeking bioremediation-based strategies to detect and detoxify organophosphorous compounds. As part of the General Microbiology Laboratory course (BIOL 3015), which is run as a Curriculum-based Undergraduate Research Experience (CURE), students isolate paraoxon-degrading bacteria from soils where pesticides have been historically used. Our research team has subsequently analyzed the identified bacterial isolates using enzymatic assays to quantify and compare the paraoxon-degrading ability of each isolate. This work reports on five different Pseudomonas species which we have confirmed to possess promising pesticide-degrading activity. Future work will include whole genome sequencing of each isolate and cloning of the relevant genes.

Title: Exploration of Microbial Biodiversity in Ephemeral Pools

Author: Connor Noland, Melanie Bray Schriver

Mentor: Dr. Roger Gold

Abstract:
Ephemeral pools are short-term bodies of water that develop a complex, yet understudied ecosystem during periods of rainfall. Because these pools are often found in deserts, the organisms inhabiting these pools complete their entire life cycle in periods as short as two weeks. While the aquatic animals of these ephemeral pools have been well studied, the microbial elements have been largely overlooked. In this project we have

sought to characterize the various bacteria and archaea found in the ephemeral pools of the Three Peaks area of Southern Utah. Water samples were collected every 48 hours from six pools distributed across three sites, which were then sequenced using Illumina next-generation sequencing and analyzed using Mothur bioinformatics analysis software (mothur.org). Alpha and beta diversity of the microbes in the pools were calculated; the sequences were grouped into Operational Taxonomic Units (OTUs,) and the percent abundance of all taxa was determined. This study will help elucidate the complex interactions between macroscopic and microscopic species within these unique ecosystems.

Title: Investigation of the Gut Microbiome of the Fresh Water Leech, Helobdella modesta

Author: Emily Burns, MaKella Steffensen

Mentor: Dr. Roger Gold

Abstract:
Sanguivorous leeches, those that feed on the blood of vertebrate organisms, maintain a symbiotic relationship with bacteria of the genus, Aeromonas. Within the leech, these bacteria help digest blood and provide essential nutrients to the host. However, very little research has been published on the gut microbiomes of non-sanguivorous leeches, with some researchers even suggesting that these species lack any microbiome. Therefore, we investigated the gut microbiome of the fresh water leech, Helobdella modesta, to gain a more comprehensive understanding of their complex host-symbiont relationships. Using Illumina sequencing techniques and Mothur analysis we surveyed the diversity and abundance of symbiotic gut bacteria. Alpha and beta diversity were calculated; sequences were grouped by Operational Taxonomic Units (OTUs), percent relative abundance for all taxa levels were calculated, and BLAST searches were performed.

Title: Characterizing a Salt-resistant Mutant in Drosophila melanogaster

Author: Tina Ngo, Gayani Nanayakkara

Mentor: Dr. Roger Gold and Dr. Aylin Rodan University of Utah

Abstract:
Our lab uses Drosophila melanogaster (fruit fly) to understand the effects of salt on the body. We previously showed that a heterozygous mutation (EY-P283/+) in the gene locomotion defect (loco) protects against death on a high salt diet. To further characterize loco mutant flies, we performed the following assays: 1) Wing measurements: EY-P283/+ flies have larger body weight relative to controls. To determine whether the larger body weight in EY-P283/+ flies is due to larger body size, I dissected out the left wing of male and female flies and imaged them using a microscope. Male but not female EYP283/+ wings were larger than controls. 2) Climbing assay: Homozygous loco mutation impairs the climbing ability of flies. However, it was not known whether EY-P283/+ flies have impaired locomotion. My data revealed that female EYP283/+ flies do not show significant differences in their climbing ability. However, relative to the controls, male EY-P283/+ flies demonstrated enhanced climbing ability. 3) Smurf assay: Gut barrier function is essential for survival and deteriorates with age. As EY-P283/+ flies have a longer life span, we tested whether they have a better gut barrier function using the SMURF assay. I found that there is no significant difference between the gut barrier function of aged EY P283/+ and aged control flies. This suggests that the longer life span observed in EY-P283/+ flies is not due to impaired gut barrier function. Overall, the aim of this study was to characterize this heterozygous mutant and to better understand its salt resistance.

Title: Microbial Diversity in Hot Springs

Author: Ashley Rodewald, Danielle Patton,

Mentor: Dr. Roger Gold

Abstract:
The microbial diversity of hot springs from around the world is studied frequently. However, the microbial diversity of hot springs in southern and central Utah and eastern Nevada have been minimally studied. In an attempt to rectify this, we sampled hot springs located around Utah and Nevada to further explore the microbial diversity therein. More specifically, this study explored the effects of physical, chemical, and anthropogenic factors on microbial diversity in seven hot springs located throughout these regions. We collected a one-liter sample of water from each location while also recording temperature and GPS coordinates. We filtered the water samples through a 0.25 μm pore-size filter and sent them to the University of Connecticut Microbial Analysis and Research Services lab (MARS) for Illumina DNA sequencing. The remaining water was sent to the SUU water lab for analysis. We analyzed the DNA sequencing results using the Mothur bioinformatics data processing software package to measure microbial diversity; operational taxonomic units (OTUs) were compared with water lab results and geographical location to explore similarities and differences in microbial diversity.

Title: Isomerization of (E)-β-Bromostyrene Derivatives

Author: Allie Mackay, Trace Wilson

Mentor: Dr. Nathan Werner

Abstract:
Isomerization reactions are important in synthetic and industrial synthesis. The conversion of E/Z double bond isomers is especially important. The Z isomer is difficult to synthesize, however, due to high energy steric interactions formed between substituents. One method, which uses a ruthenium metal catalyst and visible light to isomerize (E)-beta-bromostyrene has proven to have relatively high stereoselectivity for the Z isomer. However, the limitations of this catalyst in more complex chemical environments has been less understood. We investigated the steric and electrochemical affects different aryl substituents have on the efficiency of (E)-beta-bromostyrene isomerization. Different methods were applied to synthesize (E)- β-bromosytrene derivatives in preparation for isomerization. The E/Z ratios achieved after isomerization via visible light and ($Ru(bipy)_3Cl_2$) were measured using NMR.

Title: Palladium-Catalyzed Cross-Coupling Reactions of Styrenylboronic Acid Pinacol Ester Derivatives with

Aromatic Bromides

Author: Colin C. Barnett, Dr. Nathan S. Werner

Mentor: Dr. Nathan S. Werner

Abstract:
Molecular geometry, the spatial orientation of atoms, plays a vital role in the overall stability and reactivity of a molecule. Stilbene compounds are an example of molecules with defined molecular geometry. They contain a central ethylene moiety with two aromatic groups on the same side of the carbon-carbon double bond (cis) or flanking opposite sides of the carbon-carbon double bond (trans) configuration. A review of literature reveals the challenge of synthesizing pure trans-stilbene compounds. In addition, these important compounds show a variety of biological activity that is affected by the molecular geometry of the ethylene moiety. The palladium-catalyzed Suzuki-Miyaura cross-coupling reaction provides a mild and stereoselective way to synthesize trans-stilbene derivatives in high geometrical purity. The effect of electronic variation on the organometallic donor (styrenylboronic acid pinacol ester) on the yield and geometrical selectivity on the Suzuki-Miyaura cross-coupling reaction was studied. Derivatives of five different substituents on the organometallic donor were synthesized. Optimization of the phosphine ligand was critical in obtaining the

trans-stilbene products in high yield and geometrical purity. This work will improve the versatility of this method in the organic synthesis of medicines, materials, and fine chemicals.

Title: Synthesis of Alkyl Substituted trans-Alkenes by Palladium-Catalyzed Cross-Coupling Reaction

Author: Shoma Mukai, Dr. Nathan Werner

Mentor: Dr. Nathan Werner

Abstract:
Many alkenes are used as starting materials for the synthesis of detergents, drugs, and pesticides. The palladium-catalyzed Suzuki-Miyaura cross-coupling reaction is an efficient method to synthesize trans-alkenes of specific stereochemistry. We first studied the synthesis of alkyl substituted alkenyl boranes by 9-BBN-catalyzed hydroboration reaction. Then, we studied the ability of alkyl substituted alkenyl boranes to participate in the Suzuki-Miyaura cross-coupling reaction. Here we present our research on the synthesis of alkyl substituted trans-alkenes from alkynes by a two-step hydroboration and cross-coupling reaction.

Title: Molybdenum Needs in Cryptobiotic Crusts

Author: Alexander Rich, Dylan Tatarian

Mentor: Dr. Elizabeth Pierce

Abstract:
"Cryptobiotic crust is found on many desert soils. It is made up primarily of cyanobacteria, fungi, and various prokaryotes in smaller quantities. Species vary depending on whether the crust has been recently disturbed. Among other roles, cryptobiotic crusts protect the underlying soil from erosion and fix nitrogen gas into organic compounds needed by other organisms for growth.

Molybdenum-dependent enzymes are central to nitrogen fixation and nitrogen metabolism. In a previous study, a part of the Beaver River basin northwest of Milford Utah was found to have a wide variation in molybdenum concentration, between 0.02 mg and 50 mg per kg of soil. Within a smaller section of the study area, molybdenum was found to be more concentrated in soil close to sagebrush roots and more concentrated in cryptobiotic crust samples than in the underlying soil.

This study is comparing five cryptobiotic crust samples from areas of the Milford study site with low and high concentrations of molybdenum. DNA isolated from these samples will be submitted for metagenomic sequencing. The organismal composition of each sample will be analyzed, and we will analyze possible molybdenum needs in cryptobiotic crusts by looking for sequences homologous to known molybdoenzymes. Parallel to DNA isolation, metal contents of each sample and samples of surrounding soil will be determined by ICP-MS."

Title: Substrate specificity of a periplasmic aldehyde oxidoreductase used for detoxifying aldehydes during

growth of Escherichia coli

Author: Katie Crowther, Samantha Nielsen, Jessie Alvarez, Natasha Hudson

Mentor: Dr. Elizabeth Pierce

Abstract:
"Periplasmic aldehyde oxidoreductase (PaoABC) is an Escherichia coli enzyme that is used to detoxify small

organic compounds. The crystal structure of PaoABC shows an active site that is much less closed in than active sites of similar enzymes from different organisms. We hypothesize that PaoABC's more open active site affects substrate binding affinity, and that by mutating amino acids around the PaoABC active site to make it more like other enzymes in the family, we can change its substrate binding and increase its ability to catalyze oxidation of a wider range of compounds. In this project, we are developing a protocol to overexpress active PaoABC in E. coli and are making mutants of PaoABC.

We have made three different plasmids containing the PaoABC gene: one with an N-terminal his-tag, one with a C-terminal his-tag, and one construct to express the native protein with no tag. All three constructs are expressed at high levels in E. coli when the plasmid's T7-lac promoter is induced. The C-terminally-his-tagged protein does not bind to Ni-NTA resin. Both the native and N-terminally his-tagged protein were purified, and were found to lack cofactors necessary for activity. Our current efforts are focused on expression of active enzyme and constructing mutants of the N-terminally his-tagged and native PaoABC."

Title: Cooling Molecules to Near Absolute-Zero for High-Detail Laser Spectroscopy: the SUU Laser Facility and Supersonic Beam Apparatus

Author: Seth Weston, Bryant Pace, Dr. Jacob Dean

Mentor: Dr. Jacob Dean

Abstract:
In contrast to other spectroscopy methods, the use of a high-powered laser coupled with a supersonic expansion, time-of-flight (TOF) mass spectrometer allows for the pinpointing of molecules cooled to approximately 2K. Advantages of this method include a more accurate analysis of intermolecular forces, molecular/electronic structure, and a number of other physical characteristics at molecular resolution. Prior to loading the sample, characteristics such as the melting point, UV-vis, molecular weight, and time-of-flight were calculated. According to the absorption wavelength of the sample in solution, a specific dye was used to analyze at said wavelength. With the sample in a vacuum chamber, the near 2K temperature is reached and a spectrum is recorded by scanning the wavelength of laser light. Samples of interest for this method of spectroscopy include novel crown ethers, pyrimidinones, pyridines, and pyrimidine molecules which have been previously synthesized. Future analysis of the crown ethers include clustering with single water molecules at different molecular locations and the resulting conformational changes.

Title: Paving the Road for Quantum Computing: A Characterization of Cy5 Using Spectral Analysis

Author: Alex Hall, Seth VanMaren,Dr. Jacob Dean

Mentor: Dr. Jacob Dean

Abstract:
Quantum Computing is "The use of quantum phenomena such as superposition and entanglement to perform computation" and is today's goal for future computing. Classical computers can only take bits of information in binary code (0's and 1's) to store information, limiting storage space. One unique strategy for quantum computing seeks to harness DNA's phosphodiester backbone and structure to store massive amounts of information in an extremely small space. They do this by attaching molecules capable of high energy absorbance to a strand of synthesized DNA, and using the relationships formed between these molecules to create molecular devices. Many variables factor into whether or not a molecule is a candidate for quantum computing, including how long the electrons stay in the excited state, the flexibility of the molecule, and what wavelengths of light it absorbs and emits. Though the research is still in early stages, there is a lot of potential to be found. Our study seeks to identify all the properties of the molecule Cy5, which has been used as one of these high-absorbance molecules, and in doing this to help identify how its light absorbance and florescence might be

better utilized and understood for the use of storing information for quantum computing. We did this by performing various spectral analyses, measuring both its absorbance and florescence within a buffer. By exciting Cy5 in solution and taking spectra of the absorption and emission, we can determine if the molecule is a candidate for storing data via quantum computing.

Title: Investigation of a crossed benzoin-like condensation

Author: Cali Kucifer

Mentor: Dr. Mackay B. Steffensen

Abstract:
The Benzoin Condensation is a reaction that couples two aldehydes to form an α-hydroxyketone. Originally this reaction only occurred on aromatic aldehydes but recently there have been many ways to perform this reaction on molecules that do not contain aromatic groups. In recent years, many methods of synthesizing these hydroxyketones with varying groups attached have been discovered. However, all of them require several steps or expensive materials. We believe that we can optimize a new process that avoids the problems associated with current methods by utilizing umpolung chemistry.

Title: Electrophoretic Stripping

Author: Braden Garrett, Kobe Nielson

Mentor: Dr. Chris Monson

Abstract:
All cells are surrounded by a lipid bilayer formed by hydrophilic phosphate heads and hydrophobic hydrocarbon tails. These lipid layers, also known as cell membranes, contain many proteins that facilitate intercellular signaling, nutrient absorption, and metabolism. Research on these proteins inside membranes is vital for understanding how drugs work and what the purpose is of all the different proteins. This research is difficult as most purification processes destroy the lipid bilayer or separate proteins from it. Stripping supported lipid bilayers with high velocity buffer flow is a way that proteins in bilayers have been separated into vesicles, providing the opportunity for further research. Another method to purify and select the desired proteins in a lipid bilayer is to perform electrophoresis on the bilayer. By applying current to the layer proteins aggregate into lines based off their charges. Our goal is to combine these two existing methods into one device. This device would allow for a bilayer to be formed, proteins to be separated by electrophoresis and sections of the bilayer containing the desired proteins to be stripped into vesicles allowing them to be studied in a near real world environment to better understand function and purpose.

Title: Change of Diet and its Effects on the Gut Microbiome

Author: Elle Kucifer, Debra Hanson

Mentor:

Abstract:

Title: Going with Our Gut: Discovering the Benefits of Probiotic Supplements in Healthy Individuals.

Author: Brooklyn Henderson, Debra Hanson

Mentor: Debra Hanson

Abstract:
We wanted to test how probiotics affect the gut microbiome in healthy, young people. We had a group of volunteer students that were willing to go through two trials; the first trial is to keep a consistent diet without probiotic supplements for 30 days. The 2nd trial was to keep their diet consistent but with the probiotic supplements as part of their diet. After 30 days of each trial, the students sent fecal samples for genetic analysis so we could analyze the results.

Title: Optimizing air pollution research using cost-effective collection methods.

Author: Raymond Delray, Dr. Samuel Wells

Mentor: Dr. Samuel Wells

Abstract:
An inexpensive method using microscope slides and general adhesives was evaluated using two criteria: clarity and ability to capture particles. The products used were Aquaphor, pure petroleum Vaseline, and Vaseline Original Healing Jelly, resulting in Vaseline Original Healing Jelly being the most likely candidate. Vaseline Original Healing Jelly was able to capture PS-10 particles in the highest clarity and quantity.

Title: Effects of Fluoride on Lysozyme Activity

Author: Jantzen Orton, Sydney Bond

Mentor: Dr. Samuel Wells

Abstract:
The salivary enzyme lysozyme plays a role as a first line of defense against incoming pathogens. Dental research has supported the use of water fluoridation and fluoride toothpastes to prevent dental caries. However, concerns about the safety of fluoride are common and research about the effects of fluoride on lysozyme are limited. We tested the effects of increasing fluoride concentrations on lysozyme activity using an enzymatic assay. Our preliminary data showed an inhibitory effect of fluoride at concentrations as low as 500 ppm. We recommend this area for further research and analysis.

Title: Perceptions of Modality Differences in Human Anatomy Labs During the COVID-19 Pandemic

Author: Brayden Koch, Brianna Brunson, Jennifer A. Mraz-Craig, Mary Jo Tufte

Mentor: Jennifer A. Mraz-Craig, Mary Jo Tufte

Abstract:
The worldwide COVID-19 pandemic has caused drastic differences to educational modalities for undergraduate university students. During the pandemic, students at Southern Utah University (SUU) had the option to take Human Anatomy courses in a traditional face-to-face format or through an online, remote-synchronous course. Due to these vast differences in learning modalities available to students, we performed this research study to analyze potential differences between class modality types. End of course surveys were administered in the Fall of 2020 and Spring 2021 semesters to students of both online and in-person classes. Students were asked about the positive aspects and biggest challenges of their course's modality. These surveys were analyzed using an inductive coding approach, resulting in themes that convey what students liked about their course modality and what was the most challenging. Students who participated in-person most frequently reported they benefited from the hands-on aspect of the lab and the interpersonal aspect of working directly with the professor,

teaching assistants, and other students. Comparatively, online lab students enjoyed the convenience of working at their own pace and having access to recorded course content. While the majority of in-person students did not report any particular challenge, the common complaints with respect to the online modality were the lack of physical resources, such as cadavers, and the hardships of technological difficulties. Recommendations for improving online labs include: 1) providing more hands-on, interactive lab activities, and 2) encouraging collaborative group work and content review for learning anatomy.