2018 SAMURS

Research Talks

- **Research Talk by Keefe Brockman**

  Oncorhynchus kisutch Pre-Spawn Mortality in Swan Creek, Tacoma, WA

  Urban sources of pre-spawn mortality (PSM) in *Oncorhynchus kisutch* are of great concern for the stability of the species. Most of the studies conducted up until this point have been restricted to King, Snohomish, and Skagit Counties. *O.kisutuch* have shown a greater level of susceptibility to PSM, especially when the spawning stream is in close proximity to urban areas with a high amount of impermeable surfaces. In some cases, PSM was as high as 60-100% of spawning age females die before they have the chance to spawn. In conducting weekly stream surveys utilizing the same protocols as King County, we have been able to quantify the presence of PSM in Swan Creek, Pierce County, WA at 27-35%. In addition, our findings matched those predicted in a landscape model developed to predict PSM in the Puget Sound basin. The results of our study seem to suggest that there was a minimum amount of rain needed to elicit a PSM event in Swan Creek (>2cm/day). In the future this study will hopefully be able to collaborate with Dr. Edward Kolodziej's research on PSM to elicit the pollutant that is causing these events, as well as gather more data each year to better show the trends of these events.

- **Research Talk by Abi Deleon**

  Characterization of Fc and Fab Glycans in IgG

  Alzheimer's disease (AD) is a neurodegenerative disorder that affects more than 5.5 million adults in the United States; this is expected to triple in the next 50 years as the population continues to age. There is no known cure for AD partly because the disease progression is poorly understood and effective therapy is limited by the blood brain barrier (BBB). Purified immunoglobulin G (IgG) from human blood (aka IVIG) is investigated as a possible therapy because it contains a population of antibodies that target b-amyloid aggregates. Recent studies in the Finke lab show that α2,6-sialylated glycans on IgG antibodies can decrease BBB efflux, thereby increasing drug exposure in the brain. However, the exact glycan structure or location of these sialylated glycans is still not fully known. Here, we investigate this question by selectively cleaving glycans from the Fc and Fab regions of IVIG antibodies with subsequent fluorescent labelling and analysis via High Interaction Liquid Chromatography (HILIC/HPLC). The cleaved glycans from the Fc region showed peaks similar to a commercial glycan standard. While glycans from the Fab region appear to have increased sialylation (~40%) consistent with prior studies, qualitative integration is not consistent with the high level found in these studies (~90%). This result highlights the need for future studies that isolate the Fc and Fab domains prior to glycan cleavage. These methods will enable a better profiling of

IgG glycans and help identify the glycans best able to improve pharmacokinetics of medication for central nervous disorders including AD.

- **Research Talk by Tracie Barry**

  Temporal and Spatial Variability of Phytoplankton Assemblages in Clayoquot Sound, BC, Canada

  Clayoquot Sound is a fjordic estuary on the west coast of Vancouver Island, BC, Canada. Given the complex topography and bathymetry of this region, many of the inlets are susceptible to periodic hypoxia/anoxia, as well as dramatic spatial and temporal fluctuations in oceanographic properties which influence local primary productivity and phytoplankton abundance. The University of Washington Tacoma has been collecting water property data, phytoplankton, sediment and plastics samples in Barkley and Clayoquot Sounds since 2001. In the fall of 2014, Pacific Northwest estuaries experienced an anomalously warm intrusion of water ("the blob") from the upper eastern Pacific Ocean. For this presentation annual pre- and post "blob" time series of autumnal phytoplankton assemblages for Tofino Inlet within Clayoquot Sound were compared for 2013, 2014, 2016 and 2017. A seasonal comparison of autumn and spring 2017 phytoplankton communities will also be presented. Evidence of increased water temperature and decreased dissolved oxygen were found within the inlet. Changes in phytoplankton group composition were also apparent, with an increased prevalence of dinoflagellate genera, of which most harmful species are comprised. Phytoplankton total abundance, as well as the presence harmful algal species, may have long term impacts on local aquaculture. This study may allow aquaculture managers to better predict and mitigate the effects of future warm water influences.

- **Research Talk by Doug Bonno**

  Submarine Bathymetry Following a Massive Tsunami, Alaska

  On October 17, 2015 a large landslide ($76x10^6$ m^3) collapsed onto the terminus of Tyndall Glacier, entered Taan Fiord and triggered a massive tsunami with a maximum runup of 192m. Taan Fiord recently deglaciated between 1961 and 1991 retreating over 17 km leaving a currently stable terminus since those years. High-resolution maps of mega landslides and tsunami erosion are uncommon, presenting a rare opportunity to fill a knowledge gap. Data collection from a state-of-the-art Unmanned Surface Vessel (USV) equipped with a multibeam sonar was used to map, in high-resolution, the bathymetry of Taan Fiord. Unusual dunes were observed in a shallow bay ~8.5 km down-fjord from the landslide. They are unusual because the tidal energy in this enclosed bay is minimal, and likely too low to have generated bedforms. Instead, the dunes likely formed as the tsunami traveled through the bay. The tsunami also stripped ocean floor sediments, exposing formerly buried glacier ice left behind after the glacier retreated from that point in 1982. The exposed ice melted, leaving kettle holes up to 171 m across. We quantify dune morphology and compare with similar measurements from fluvial and marine settings.

Current works involve analyzing flow vectors and calculating sinuosity of 1375 crestlines in the shallow bay.

Abstracts

- **Localization and Activity Dependence of Presynaptic GRIP1 Colocalization with GluR2/3 in Excitatory Terminals in Visual Cortex**

  Pragya Adhikari and Marc Nahmani

  Capstone Advisor: Marc Nahmani

  Monocular Deprivation (MD) is a classic paradigm for brain plasticity. MD is a way to test for plasticity of brain by closing one eye for a period of time. One form of this plasticity is known as the homeostatic plasticity, in which neurons innervated by the deprived eye shows a remarkable capacity to rebound its neuronal activity back to its baseline firing rate. MD causes a drop in neuronal activity after 3 days, but by 6 days neurons in visual cortex achieve a homeostatic rebound in firing rate. Glutamate receptor-interacting protein 1 (GRIP1) specifically binds to the C termini of AMPA receptor subunits and these receptor binding proteins are necessary for homeostatic plasticity of excitatory synapses (Gainey et al., 2015, Tan et al., 2015). GRIP1 is thought to perform this role by recruiting and/or binding GluR2 /3 (Subunit 2 & 3-containing AMPA Glutamate Receptors) at the postsynaptic side of synapses. However, GRIP1 is also present at the presynaptic side of synapses. Whether presynaptic GRIP1 associates with GluR 2/3, and whether/how presynaptic GRIP1 density is altered by brief activity deprivation with respect to presynaptic GluR 2/3 remains unknown. Therefore, we investigated the density of presynaptic GRIP1 and GluR2/3 in control and deprived hemispheres of monocular primary visual cortex after 3 days of MD. We found that within the excitatory presynaptic terminals in visual cortex, a brief period of deprivation induces an increase in GRIP1 protein density and a decrease in GluR2/3 protein density. Our preliminary results suggest that presynaptic GRIP1 and GluR2/3 play separate, potentially opposing roles in regulating excitatory synapse strength after brief activity deprivation.

- **Data Entry + Management for Health Research**

  Sean A. Ahrens, Karen Cowgill, and Abel Ntambue

  Capstone Advisor: Karen Cowgill

  This project focused on creating a method of data entry and management for health research in a resource-constrained setting, specifically, for a large-scale community-

based survey about infant feeding practices in an urban setting in the Democratic Republic of the Congo (DRC) conducted by students at the University of Lubumbashi School of Public Health in May 2017. I developed a workflow within the constraints of materials that allowed for this to be completed efficiently. Firstly, I learned to use free software (EpiInfo v7, CDC, Atlanta, GA) that addressed the budget constraints, EpiInfo was also compatible within technological constraints in the DRC. Then, taking the data, I learned how to organize and clean it to ensure accurate results. Lastly, I then wrote code in the "R" language to analyze the results. By doing this, I was able to create a way for this project's large-scale resource-constrained data management and analysis to be done.

- **Storm Water Monitoring at Normandy Park**

Ernesto Alegria, Edward Kolodziej, Katherine Peter, and Sarah White

Capstone Advisor: Edward Kolodziej

Urban stormwater runoff disrupts the health of many natural bodies of water. The water quality of these types of storms is difficult to monitor because their base flow changes drastically during a hydrograph. The objective of this study was to determine which sampling method would prove useful at collecting contaminants over the course of an urban storm water event. For this experiment, the same site was sampled during storms three times. Two different methods were used to determine what organic contaminants or compounds are found in Miller creek, an urbanized creek impacted by stormflow. To collect composite samples, we used an ISCO sampler, which is an automated composite sampler. It has the ability to intake fixed volumes of water through a storm, allowing the averaged concentration of contaminants of an urban storm water runoff to be estimated. The other method is the grab sample, which requires someone to scoop up samples from a creek and place them in an amber glass bottle, providing an instantaneous measure of water quality at that time. These are different sampling techniques that have both advantages and disadvantages against collecting storm water runoff. This is an important experiment, because we want to monitor and minimize the effects of contaminants entering the ecosystem. Therefore, we need to understand time periods of maximum contaminant flows during a storm. Instrumental analysis was used to measure different pollutants in the composite and grab samples, and the samples techniques were compared .As one example, tTetraethylene glycol monobutyl ether ($C_{12}H_{26}O_5$) is found in all samples with high concentrations. There are many organic contaminants that are detected in urban storm water run-off. Solutions in finding the precise method of collecting all possible compounds in contaminated sites is still a difficult task.

- **Restoration at Titlow Park**

Tim Allcock, Keith Bergeron, Amy Boucher, and Regan Churchill

Capstone Advisor: Cynthia Updegrave

Titlow Beach Park serves as a recreational outlet for residents of Tacoma, and is a successional deciduous forest surrounded by residential neighborhoods.Invasive plant species have slowed succession and greatly diminished visibility within the forested areas.An area adjacent to parking spaces for guests had become overgrown with these species, becoming a factor in illicit drug use and increased crime.Beginning in Autumn 2016, our University of Washington Restoration Ecology Network (UWREN) team spent several months thoroughly removing invasive plant species and applying a thick mulch to inhibit re-infestation. In the Spring we planted several dozen native plant species, taking note to preserve an ephemeral stream that transects the restoration site.We drafted a monitoring plan along and watering suggestions to promote low plant mortality over Summer 2017.Throughout this process, we worked with our client, Tacoma Metro Parks, to restore the site and encourage community engagement, as well as cultivating the social benefits of ecological restoration in urban areas.This project was a continuation of a restoration project from 2015-2016 and the site was chosen again in 2017-2018.With three consecutive years of restoration at this site, the hope is that future capstone teams will continue to restore and maintain this area.Reported crime and theft has decreased in the parking lot while utilization and leisure in the area have increased leading to more accessibility to Titlow Beach.Inhibiting invasive growth and planting coniferous trees will allow this area to progress toward and old-growth forest over time.

- **Pervious Pavement: Building a More Sustainable Campus**

Austin Arant

Capstone Advisor: Kim Davenport

Pollution from stormwater runoff into the Thea Foss Waterway is an ongoing concern for the community. The UWT has the opportunity to help mitigate this problem by incorporating pervious pavement on campus, which would allow more stormwater to infiltrate underground, filtering the pollutants out. The feasibility of installing pervious pavement on campus was investigated. To this end, several local suppliers and contractors were contacted to see if they can install this rather specialized material. It was found that there are certified installers of pervious pavers in the area. Even though the costs of these materials are higher than standard pavement, less stormwater infrastructure is necessary, which can offset the overall price of the project. In addition, installing pervious pavement can assist in gaining Leadership in Energy and Environmental Design (LEED) certification for development, and present a more sustainable image to the community. Overall, incorporating pervious pavement will create tangible benefits for the UWT as well as help reduce the impacts of stormwater runoff.

- **Development of a Database of Preterm Premature Rupture of Membranes (pPROM) in High -, Medium -, and Low – Human Index Countries**

  Aaron Arzaga, Karen Cowgill, Olivia Eisner, Cornelia Rolfe, and Selyna Villareal

  Capstone Advisor: Karen Cowgill

  Preterm birth (PTB) continues to be a significant global health issue, with estimates suggesting 15 million infants are born prematurely every year. Defined as birth prior to 37 weeks' gestation, PTB is the leading cause of death in the first 28 days of life, and the leading cause of death in children under the age of 5. Though the etiology of PTB is multifactorial and often unidentified, approximately 20-40% of PTB cases are associated with preterm premature rupture of membranes (pPROM) – the spontaneous .

- **Sustainable Growing Practices of Cacao Plants in Response to Rain Forest Destruction in Costa Rica**

  Darren Aseron and Robert Tourney

  Capstone Advisor: Robert Tourney

  The rainforest in tropical regions are unique environments that not only provide home to an abundance of different flora and fauna but also provide ecosystem services for us as well. However, because the resources they produce they are being threatened by commercial farming practices that change the landscape and introduce chemicals that affects the biodiversity in the area. Costa Rica is an example of this, as many corporations came to the country to setup plantations of palm oil, coffee, bananas, pineapples, and other tropical produce, and have damaged the landscape as a result. To study this issue, we explored the concept of sustainable agriculture methods in Mastatal, a small rural town in Costa Rica, where we stayed for four weeks from August to September 2016, learning and practicing sustainable methods of producing organic chocolates and other food crops as a potential method to reduce agricultural impact on local biodiversity. We experienced that it is possible to use sustainable agricultural methods, such as landscape contouring or grafting crops together for hybrids with multiple traits, to conserve resources while still maintaining production. Despite the small scale, these practices serve as a starting point on how sustainable agriculture could be incorporated into the industrial agricultural practices of large corporations.

- **Temporal and Spatial Variability of Phytoplankton Assemblages in Clayoquot Sound, BC, Canada**

  Tracie Barry, Lyndsey Claassen, Cheryl Greengrove, and Julie Masura

Capstone Advisor: Cheryl Greengrove

Clayoquot Sound is a fjordic estuary on the west coast of Vancouver Island, BC, Canada. Given the complex topography and bathymetry of this region, many of the inlets are susceptible to periodic hypoxia/anoxia, as well as dramatic spatial and temporal fluctuations in oceanographic properties which influence local primary productivity and phytoplankton abundance. The University of Washington Tacoma has been collecting water property data, phytoplankton, sediment and plastics samples in Barkley and Clayoquot Sounds since 2001.In the fall of 2014, Pacific Northwest estuaries experienced an anomalously warm intrusion of water ("the blob") from the upper eastern Pacific Ocean.For this presentation annual pre- and post "blob" time series of autumnal phytoplankton assemblages for Tofino Inlet within Clayoquot Sound were compared for 2013, 2014, 2016 and 2017. A seasonal comparison of autumn and spring 2017 phytoplankton communities will also be presented.Evidence of increased water temperature and decreased dissolved oxygen were found within the inlet. Changes in phytoplankton group composition were also apparent, with an increased prevalence of dinoflagellate genera, of which most harmful species are comprised. Phytoplankton total abundance, as well as the presence harmful algal species, may have long term impacts on local aquaculture. This study may allow aquaculture managers to better predict and mitigate the effects of future warm water influences.

- **Identifying Sources of Fecal Coliform in Streams that Lead to Poverty Bay in Puget Sound, Washington**

Joseph Bell

Capstone Advisor: Andy James

The Puget Sound is Washington State's premier recreational and commercial water source. Washington State is the largest commercial producer of shellfish in the nation. Harmful algal blooms create hazardous toxins in the Puget Sound, which prevent people from using the water for recreation and commercial shellfish harvesting. Pollution in the Puget Sound causes harmful algal blooms to occur frequently. This purpose of this study was to look for sources of pollution in a stream that leads directly into the Puget Sound, specifically the Poverty Bay. Massey Creek in Des Moines, Washington was the location of the study. The type of pollution identified was fecal coliform and chemicals of emerging concern. We found insignificant amounts of chemicals of emerging concern and fecal coliform at all sites at Massey Creek. This information was archived at the Center for Urban Waters in Tacoma, Washington. The Center for Urban Waters shares the data they collect with local governments so that cities can make informed decisions about how to manage their waterways.

- Keith Bergeron – See abstract for Tim Allcock

- **Exploration of Microplastics in the Lower Puyallup River Watershed**

  Shannon Black, Jessica Kelsey, Mary Eldridge, and Julie Masura

  Capstone Advisor: Julie Masura

  Microplastics are polymers < 5mm, varying in shape, color, chemical composition, and density. Manufactured plastics are primary microplastics which include pellets, fibers, and microbeads. Secondary microplastics are plastics fragmented through photodegradation and/or mechanical weathering. Research has documented microplastics in high densities (e.g., 100,000 items per m^3) in marine environments, but little work has been conducted in riverine environments. Our study is focusing on the Puyallup River Watershed, located in Washington State, and its role in microplastic transport. The Puyallup River and its two principal tributaries, the White River and the Carbon River, drain a watershed of approximately 1,040 square miles and stream from several glaciers located on Mount Rainier, including the Puyallup Glacier. During our preliminary research, samples were collected monthly, both upstream and downstream of municipal wastewater treatment plants, from five cities in the lower reaches of the Puyallup River Watershed. Fibers, fragments, and foams were identified, characterized and quantified. Only 1-foam and 5-fragments were found, with the majority being fibers. The concentration of fibers, ranged from 0 to 204 fibers/L, with an average of 22-fibers/L in each sample collected. Results were statistically inconclusive to determine if wastewater treatment plants were a point source of plastic pollution to the Puyallup River Watershed, although more fiber numbers were located upstream than downstream at most sites.

- **Global Impact: "Magical Morocco"**

  Sehar Bokhari, Ilianna McDaniel, Diamond O'Neill, Jazmin Sanchez

  Capstone Advisor: Erica Cline

  The Global Impact program seeks to send students beyond borders, breaking down barriers between health education and inequities. Program participants play an integral role in the fight to spread awareness and gain a solid understanding of the limitations of a third world country to have adequate access to quality healthcare and sustainable agricultural resources. In the interest of causing direct change, four University of Washington Tacoma students traveled to Agadir, Morocco and surrounding villages for two weeks in late August of 2017. The participants shadowed physicians in a private hospital, observed a variety of surgeries, volunteered at local orphanages, and aided in the process of

developing 3 rural village mobile clinics working with physicians to treat patients that walked miles to be seen. Participants also facilitated the removal of rocks and other sediment, developing sustainable farmland for a remote village off the coast of the Atlantic, while also clearing beaches and providing emergency medical healthcare. Taking part in this experience allowed us to generate a greater understanding and respect for the world around us - thus pushing us to make more of an effort to learn about different cultures and not only aid others but also grow within ourselves.

- **Submarine Bathymetry Following a Massive Tsunami, Alaska**

  Doug Bonno, Dan Shugar, and Jeremy V. Venditti

  Capstone Advisor: Dan Shugar

  On October 17, 2015 a large landslide ($76x10^6$ m^3) collapsed onto the terminus of Tyndall Glacier, entered Taan Fiord and triggered a massive tsunami with a maximum runup of 192m. Taan Fiord recently deglaciated between 1961 and 1991 retreating over 17 km leaving a currently stable terminus since those years. High-resolution maps of mega landslides and tsunami erosion are uncommon, presenting a rare opportunity to fill a knowledge gap. Data collection from a state-of-the-art Unmanned Surface Vessel (USV) equipped with a multibeam sonar was used to map, in high-resolution, the bathymetry of Taan Fiord. Unusual dunes were observed in a shallow bay ~8.5 km down-fjord from the landslide. They are unusual because the tidal energy in this enclosed bay is minimal, and likely too low to have generated bedforms. Instead, the dunes likely formed as the tsunami traveled through the bay. The tsunami also stripped ocean floor sediments, exposing formerly buried glacier ice left behind after the glacier retreated from that point in 1982. The exposed ice melted, leaving kettle holes up to 171 m across. We quantify dune morphology and compare with similar measurements from fluvial and marine settings. Current works involve analyzing flow vectors and calculating sinuosity of 1375 crestlines in the shallow bay.

- Amy Boucher: See abstract for Tim Allcock

- **Global Impacts: Discover Laos**

  Andrew Boupha, Tatiana Hyldahl, Jess Kern, and Katelyn Tozer

  Capstone Advisor: Erica Cline

Access to and utilization of healthcare services are crucial for individuals around the world in order to decrease the chances of illness or mortality. Laos is not only an underdeveloped nation, but it has 10.4 skilled health professionals per 10,000 residents.Our mission was to serve the rural area of Laos through hosting mobile health clinics and participating in a sustainability project. Through the clinics we assessed villagers and provided basic health care, vitamins, and antibiotics to those in need. During these clinics we taught the village about proper teeth brushing, hand washing, and hygiene techniques in order to lower the possibility of disease spreading throughout the villages. Through a water sustainability project, we aimed to combat waterborne illnesses as well. In this three-day project we built the concrete foundation and installed an underground water system to provide clean water to the hospital in Ban Huay Pho village. Though we only had the privilege to see six villages in Pak Xeng district, covering only a small portion of the mountainside, we successfully provided care to 484 families consisting of 2,559 Lao people, and provided clean water and medicine to the nearby hospital.

- **Analysis of Antimicrobial Overprescription by Health Care Providers in Pierce County in 2015-2016**

  Mylissa Bowlin, Melissa Jimenez, Karen Cowgill, and Matthew Rollosson

  Capstone Advisor: Karen Cowgill

  Prescribing antimicrobial drugs to treat bacterial infections has been a popular method of treatment for healthcare providers for decades in the United States. However, recent research has shown this may not be the best option for all bacterial infections. Many diarrheal causing bacteria are self-limiting and do not require treatment other than staying hydrated and possibly taking probiotics, but the push for medicinal treatment continues. Antimicrobials not only kill bacteria that are harmful to the host but also the healthy flora that is necessary for digestion; however not all bacteria, healthy or not, is killed off. When this occurs, the bacteria that are left now have an acquired memory to the antibiotics used and how to fight them off, they continue to multiply and spread this memory to the new bacterial cells. This has posed a threat to the medications we have to prescribe patients for more serious life threatening infections.

  One of the many responsibilities the Tacoma-Pierce County Health Department (TPCHD) has is to investigate all reported cases of Campylobacteriosis, Salmonellosis, and Shiga Toxin producing E. coli (STEC). Over the course of four years (2012-2016), TPCHD has analyzed data collected from reported cases to determine whether their recommendation to prescribe antimicrobial drugs for these bacterial infections only to children under 5, over the age of 70, and/or have a compromised immune system was followed. During the course of a nine-week internship at TPCDH, we collected data from 511 cases reported between the years of 2015-2016 and compared the results from a

previous analysis done for 2012-2014. We found that a statistically significant portion of reported cases had been prescribed on or more antibiotics for treatment of self-limiting infections. Campylobacteriosis was the most common over all age groups prescribed antibiotics. Our findings show that there has not been a significant decrease in the percentage of patients prescribed antibiotics for these infections.

- **Arsenic Bioremediation Using Non Invasive Aquatic Plants**

Brandon Brooks and Johanna Wilson

Capstone Advisor: Jim Gawel

Arsenic is a toxic metal found in the environment and a cause of water contamination problems worldwide. Arsenic is a carcinogen, creating various health problems in humans such as high blood pressure, and diabetes. Recently, elevated arsenic concentrations were measured in surface waters of Lake Killarney, Washington, where many people swim, and fish. Past methods such as oxidation, ion exchange, and membrane processes were somewhat effective, however, the cost was substantial and there were issues with toxic byproducts.

In this study, we investigate the potential for bioremediation of arsenic in lake water using aquatic plants. This could provide a cost effective way to remove arsenic in Washington lakes and other contaminated waters around the world.

In this study, five species of aquatic plants common to Washington (Rotala indica, Caltha palustris, Dulchium arundinaceum, Juncus effusus, and Iris ensata) were planted in the arsenic-contaminated sediments collected by dredge from Lake Killarney in a water-filled aquarium. Plants were placed in a growth chamber on a 16/8 hour day/night light cycle at 20°C to mimic summer conditions in the Pacific Northwest. We tested each plants arsenic levels using an ICP-MS machine to determine which plant absorbed the most. Our study provides data to identify aquatic plant species that can safely and cost effectively remove arsenic from surface waters, and decrease exposure to humans and the ecosystem as a whole.

- **Analysis of Alexandrium spp. Cysts in Bellingham Bay, Puget Sound, WA**

Jacqueline Busby, Solomon Harvey, and Julie Masura

Capstone Advisor: Julie Masura

The dinoflagellate *Alexandrium* spp. is a source of toxins in Puget Sound shellfish and can cause paralytic shellfish poisoning. An individual ingesting shellfish containing these

toxins might experience mouth and limb numbness, serious illness or death.The University of Washington Tacoma and Washington State's Department of Ecology have partnered together through the Puget Sound Ecosystem Monitoring Program to monitor the presence of *Alexandrium* cysts throughout the Puget Sound. This study looked at the 2017 cyst bed developing in Bellingham Bay. Cyst presence and concentration was described as well as the relationship with the sediment particle grain size and total organic content. Observed minimum cyst abundance was 10 cysts, maximum was 607 cysts, and average was 30 cysts per mL of wet sediment. There was no significant relation with particle grain size.A slight correlation ($R^2 = 0.42$) was found between total organic content and cyst abundance. Through monitoring of cyst distribution throughout the Puget Sound, it is our hope we can better inform our state and local government agencies of the potential presence of paralytic shellfish toxins and risk of paralytic shellfish poisoning in consumers.

- **Development of Neuronal Spinules in Primary Visual Cortex**

Charles Campbell, Adam Knyaz, and Marc Nahmani

Capstone Advisor: Marc Nahmani

Synapses are the site of communication between two neurons that (underlie) all of our behavior. These synaptic areas may be held in a more permanent state and therefore 'stabilize' behavior by protrusions called spinules. Spinules are long thin projections that can be found extending from the postsynaptic 'information receiving' ends of synapses (i.e. spines or dendrites) into presynaptic 'information sending' ends of synapses (i.e. boutons). Although the exact mechanisms of spinule function has not been clearly established, several studies have provided insight to possible mechanisms. Structural support of synaptic areas and cell to cell signaling have been suggested as possible functional roles of synaptic spinules. In prior studies spinules have been examined in the hippocampus, this research is novel in that it focuses on the cortex. Spinule prevalence may increase with age in ferrets reaching maximum numbers at adult.

To better understand the developmental aspect of spinule prevalence tissue sections taken from the primary visual cortex (V1) of postnatal ferrets at 2 age groups (60 days postnatal and adult) and they were imaged using electron microscopy. Approximately 30 synapses were analyzed for their fine anatomical detail. Spinule presence and morphology at each synapse was also measured. At age 60 days a prevalence of 10% was observed in adults, there was a slightly higher percentage of spinules measured at 14.7%. Further analysis also determined a greater spinule perimeter size in adults averaging 1.14 µm and only .76 µm in postnatal 60 days. The increased size and prevalence in spinules in adults suggests that their function is likely increasingly important as ferrets age from adolescence to adulthood.Future research exhibiting statistical power due to larger sample sizes should be carried out to support these findings.

- **Mycorrhizal DNA on Douglas-Fir (*Pseudotsuga menzlesll*) Root Systems in the Elwha River Valley**

  Laura H. Casillas

  Capstone Advisor: Erica Cline

  Mycorrhizae fungi live in the soil and have a symbiotic relationship with plants, helping them to take up water and nutrients more effectively, as well as have an increased resistance to drought and stress. As part of a re-forestation effort, selections of Douglas-Fir (*Pseudotsuga menziesii*) seedlings were planted on the site of a former dam in the Elwha River valley. Each seedling was inoculated with either soil from an established, mature forest or with soil that had been sterilized. The presence of mycorrhizae in the mature forest soil had been confirmed in a previous study. It was hypothesized that the soil brought in from a mature forest would help establish a healthy mycorrhizae population on the seedlings and, in turn, the seedlings would have a higher survival rate. Preliminary survival data showed that inoculated Douglas-fir seedlings had a 67.8% mortality rate and un-inoculated seedlings had a 78.3% mortality rate.Root tips chosen randomly from these seedlings were collected and morphotyped. DNA from the root tips was extracted via the CTAB (cetyl trimethylammonium bromide) method. Promising results from the DNA extraction and PCR were then sent to TACGen for sequencing. Of the 620 root tips collected, 149 likely PCR results were sent to be sequenced. Of the 149 samples to be sequenced, only 28 samples came back as testing positive for fungal DNA. This seems to suggest that the mycorrhizae fungus present in the forest soil were not able to colonize the roots of the seedlings, possibly due to the weakened status of the seedlings or the inhospitality of the valley soil.

- Regan Churchill: See abstract for Tim Allcock

- **University of Washington Tacoma; A Bicycle Friendly Campus**

  Allison Cruz

  Capstone Advisor: Kim Davenport

  The University of Washington Tacoma has made numerous changes in the past few years to become a more sustainable campus. Aiming to be a sustainable campus means that we are focused both on lessening our footprint on the environment and indulging in practices that we can continue for the entire life of the campus. Biking to work/school is a practice that increases the health of our campus population, opens up more parking for those that have to drive, and helps to lower ambient emissions around the school. Despite all these benefits, UWT does very little to present itself as “biker friendly”. Looking into how other

progressive campuses have encouraged students and employees to bike, we see that they have bike clubs, awareness events, partnerships with bike-sharing companies, and other incentives. Many people who attend UWT do not live close enough to commute by bike but even those who do live close enough, still choose not to for solvable reasons. Students from UWT were polled to see if they would be more inclined to bike to campus if there were more incentives involved or if it were made easier. The majority of students agreed that if there were changes to the biking atmosphere on campus that they would be more inclined to give the practice a try. The University of Washington Tacoma needs to work to implement incentive programs and better bike storage in order to solve numerous sustainability issues on campus.

- **Correlation Between Aging-Related Condition and High Sugar Intake in Humans**

  Nam Dang and John Finke

  Capstone Advisor: John Finke

  Aging is caused by many factors, both internal and external. AGEs (Advanced Glycation End products) have received lots of attention due to their correlation with aging. Unwanted glycation can change both the structure and function of proteins, leading to dysfunction and disease. The purpose of this project is to describe the biochemical glycation reaction and also highlight a link between sugar consumption, glycation, and aging in various tissues (skin, cardiac muscle, eyes, etc.). A review of the literature was performed and relevant connections are highlighted.

- **Characterization of Fc and Fab Glycans in IgG**

  Abi Deleon, Vanderbilt Gaditano, Ramon Garza, Aron Rigg, Amira Salim, and Dahlia Salim

  Capstone Advisor: John Finke

  Alzheimer's disease (AD) is a neurodegenerative disorder that affects more than 5.5 million adults in the United States; this is expected to triple in the next 50 years as the population continues to age. There is no known cure for AD partly because the disease progression is poorly understood and effective therapy is limited by the blood brain barrier (BBB). Purified immunoglobulin G (IgG) from human blood (aka IVIG) is investigated as a possible therapy because it contains a population of antibodies that target b-amyloid aggregates. Recent studies in the Finke lab show that α2,6-sialylated glycans on IgG antibodies can decrease BBB efflux, thereby increasing drug exposure in the brain. However, the exact glycan structure or location of these sialylated glycans is still not fully known. Here, we investigate this question by selectively cleaving glycans from the Fc and

Fab regions of IVIG antibodies with subsequent fluorescent labelling and analysis via High Interaction Liquid Chromatography (HILIC/HPLC). The cleaved glycans from the Fc region showed peaks similar to a commercial glycan standard. While glycans from the Fab region appear to have increased sialylation (~40%) consistent with prior studies, qualitative integration is not consistent with the high level found in these studies (~90%). This result highlights the need for future studies that isolate the Fc and Fab domains prior to glycan cleavage. These methods will enable a better profiling of IgG glycans and help identify the glycans best able to improve pharmacokinetics of medication for central nervous disorders including AD.

- **Bolivia, Remote Healthcare Accessibility, and Chagas Disease**

  Kokou Dogbe, Tram Duong, and Gerald Hilario

  Capstone Advisor: Karen Cowgill

  Through Child Family Health International we will be joining healthcare professionals in remote rural medical clinics, outreach home visits as well as teaching/government hospitals in Tarija, Bolivia.We will rotate with local doctors through specialties including pediatrics, surgery and internal medicine.We will learn about prevalent disease as well as how poverty affects families' access to healthcare.We have done all preliminary work leading up to our study abroad including: Beginners Spanish 1, Medical Spanish, Program-specific Material (i.e. Visa/Travel arrangements), and Prevalent Disease information. One particular condition that has affected Bolivia is Chagas disease, an infectious disease that is spread from insect to humans. The vector *Trypanosoma cruzi* (*T. cruzi*), also known as the "kissing bug", emerges from the night and starts to feed on your face.After feasting on your blood, they digest for a bit and excrement before leaving. It is the diseased excrement that you unknowingly spread through your face and become infected. Symptoms of Chagas disease include: body aches, fever, skin rash, loss of appetite, and fatigue. If the disease is untreated it could cause life threatening heart failure.After the trip, we hope to gain understanding and proficiency of how rural communities are affected through healthcare. We are excited to see how local healthcare providers provide treatments for Chagas disease. We hope that we can gain better understanding on cultural differences between the United States and Bolivia. We are aware that our point of views about the world extends with our experience.

- **Lights Out!!: Determining the Effect of Light Exposure on Movement of Bivalve Larvae**

  Justin Drake, Bonnie Becker, and Michelle McCartha

  Capstone Advisor: Bonnie Becker

The shellfish of Puget Sound have been affected by ocean acidification, pollution and commercial harvesting, which have caused one native species, the Olympia Oyster, to dwindle to almost extinction. These filter feeders are both indicators of ocean health and integral in the oceanic food web. Knowledge of natural movement of the larvae of these species is integral for understanding how we can work to improve the habitats in order to promote population growth. By determining the depth in water column preference of bivalve larvae according to time of day, we can further map their life cycles and model their connectivity among different locations. Samples were collected in Case Inlet, Fidalgo Bay, Port Gamble, and Willapa Bay at the top and bottom of the water column in both light and dark cycles. Samples were sorted and bivalve larvae were counted, as this is the only mobile stage of development. By tracking larval peaks in the data we investigated depth preference of immature bivalves, and make hypotheses about how it is affected by environmental factors such as ocean acidification. Knowing this information can help further research into habitat forming and preservation, along with maximizing area for the farming of these species. Further understanding the movement of the bivalves of the region will lead to larger, more productive populations and an improved environment.

- **Vampire Energy in Court 17, University of Washington Tacoma Apartments**

  Kevin Du, Jonas Restad, and Kim Davenport

  Capstone Advisor: Kim Davenport

  Appliances use standby power, also known as Vampire Energy which continuously draws electrical current when not in use. Wasted energy consumption produces more pollution by facilities that provide it and loses money for the owner of the appliance.The Court 17residential building located in Tacoma, WA contains refrigerators that are plugged in yearround and draw more power than any other appliance in the dorms. Summer room vacancies wereestimated based on actual vacancies, and conversion calculations were used to determine the extra pollution and cost. The quarterly cost of all operating fridges in Court 17 amounted to $5.580, used 1,016 kW/h electricity, and produced 158,919 lbs of CO_2 emissions. We propose that those who leave the dorms to add “unplugging the fridge” to their checklist of things to do before moving out or as an additional duty for employees. And for future buildings we suggest integrating controlled power switches that will allow convenient control of electrical flow to reduce consumption.

- Tram Duong: See abstract for Kokou Dogbe

- **Supplementation of Hood Canal Steelhead and Freshwater Survival**

Nickolas Dyer, Eric McDonald, and Clayton David

Capstone Advisor: Eric McDonald

Puget Sound steelhead populations are listed as threatened under the Endangered Species Act. Modern hatchery programs have been developed to aid in the conservation of depleted steelhead populations. Though, controversy has risen in the scientific and public communities on the benefits and risks of modern hatchery practices. One of these practices is releasing hatchery smolt 1 year into their life history in comparison to natural populations that typically smolt at 2 years. Also, hatcheries offer no sexual selection, which directly effects the genetics of the next generation. A novel supplementation was introduced in this study that released smolt at the 2-year stage and allowed for sexual selection of adult steelhead and determined if novel supplementation has no effect on the survival of steelhead in freshwater during and after supplementation. Steelhead smolts were captured via rotary screw trap where scale and fin clip samples were taken for age and DNA analysis, and mark and recapture method to determine smolt population. Freshwater survival was calculated using: Egg to smolt survival =(smolt population / estimated egg deposition). Data for this study was gathered from 2014 – 2017. Populations in the supplemented Dewatto (DE) and control Tahuya (TA) Rivers increased from 2014-2016. 2017 smolt population decreased in both DE and TA. Though, populations were greater than 2014 for all three streams. DE and TA seem to mirror each other in both population and freshwater survival estimations, suggesting that the hatchery practice being assessed does not impact the survival of steelhead in freshwater.

- Mary Eldridge: See abstract for Shannon Black

- **Microplastic Fibers in the Puyallup River Wastershed**

Mary Eldridge

Capstone Advisor: Julie Masura

Microplastics, defined as less than 5mm in length, are thought to stem from common items such as clothing from man-made fibers like polyester, food containers and water bottles that can end up in our waterways and even in our water that we drink. This study explores microplastics found in the Puyallup River Watershed whole water river samples before and after wastewater treatment plants along the Puyallup River and its tributaries. The hypothesis was that there would be more of the microplastic found in samples taken from the sites downstream from the wastewater treatment plants. Data showed that there was no significant difference between the number of fibers that were found in the upstream or the downstream sites. The minimum number of fibers that were ever found at the sites were 3 fibers, the mean being 71.6 fibers for upstream, 108.6 fibers for downstream, and the

maximum fibers found being 319 in the city of Sumner. The p-value that resulted from the research was 0.45 with an alpha of 0.05.

- **Effect of Hydroperiod on Nutrients and Productivity in Ponds Created by the 1980 Eruption of Mount St. Helens**

  Lionel Estrada and Jim Gawel

  Capstone Advisor: Jim Gawel

  Mount St. Helens' 1980 eruption heavily impacted the surrounding landscape, erasing some features and creating new ones, including a diverse array of lakes and ponds. New ponds in the area of the hummocks created by the landslide in the Toutle River valley span a range of different hydroperiods, with some holding melt-water only until spring, while others are continuously fed by groundwater and thus retain water throughout the year. The organisms relying on these ponds have had to adapt to each pond's hydroperiod and its subsequent effect on nutrient availability. We analyzed water samples collected from these ponds from two different years, 2015 and 2017, in order to determine whether the ponds are nitrogen or phosphorus limited. Samples were collected from numerous ponds in two different regions: (a) the sparsely-vegetated Hummocks complex and the heavily vegetated and shaded Maratta complex. We analyzed field-measured water quality data and total nitrogen and total phosphorus concentrations. Differences in Redfield ratio between the 2 complexes and across varying hydroperiods will be discussed. The results of our study will help determine the capacity for different pond-types to support different fauna, and will inform an ongoing study of ecosystem response to volcanic disturbance.

- **Hanuman Guardian 2017: Global Service Learning Experience in Thailand**

  Ashlynn Felker

  Capstone Advisor: Erica Cline

  As a Search and Rescue Air Force Medic, I was sent on a humanitarian deployment to Thailand to accompany a group of 5 other Air Force Civil Engineering personnel. The name of this event is called the Hanuman Guardian with the objective to continue the long-lasting relationship between the Royal Thai Army, and the United States military. Our mission was to work with the Royal Thai Army during the two weeks of being in Thailand, and train together on Search and Rescue tactics.

- **Importance of Honeybees and Other Pollinators in Gardens**

Hajji Frayre

Capstone Advisor: Cynthia Updegrave

The University of Washington Tacoma Giving garden gives the university and Tacoma community a safe place to hone their gardening skills and enjoy the area. The produce from the Garden also provides the community a naturally grown, GMO free food source while at the same time giving the community the opportunity to enjoy the fruits of their labor. The skills and practices gained from the garden can be translated to course curriculums at the university which will branch to several other fields of study allowing students of different fields to appreciate the Garden and the efforts that go into it. However, the garden isn't producing at its full potential, therefore, it's difficult to fully enjoy all the amenities of the garden. Based off several gardening articles and interviews with gardeners from other community gardens, it was determined that honeybees and other pollinators are key to the overall growth and health of the garden. That information was then compiled and organized for the use of current and future gardeners for the purpose of starting and/or improving their current garden. These pollinators are responsible for a majority of the food we eat. Many plant species cannot reproduce without the assistance of these pollinators which further stresses their importance on, not just gardens, but on human society as well. Overall, with the methods and strategies gathered, we expect our own community garden to flourish beautifully with flowers and vegetables and home all the pollinators that helped with the garden growing.

- Vanderbilt Gaditano: See abstract for Abi Deleon

- **Investigation of School-Based Factors That Influence Parental Consent Towards School-Located Influenza Vaccination**

  Sabrina Gan, Charles LaRocco, Kate Cranfield, Carolyn Cook, and Karen Cowgill

  Capstone Advisor: Karen Cowgill

  Influenza is a virus that causes a large burden on the healthcare system each year in the United States. It is estimated that influenza causes between 9.2 and 35.6 million illnesses, 140,000 and 710,000 hospitalizations, and 12,000 and 56,000 deaths annually (CDC 2017). Severity depends on a range of factors such as age, but symptoms can include fever, cough, sore throat, body aches, headaches, and fatigue (CDC 2017). Influenza disproportionately affects children aged 5 to 18 years of age, who experience attack rates in the range of 30-50% (Ha et al 2013). Not only are children affected at higher rates, but they are also infectious for longer periods of time than adults. According to the CDC, children can be infectious up to 7 days before symptoms appear (How Flu Spreads 2013). The ability of children to be infectious for long periods of time can put older adults (aged

65 years or older) at risk of developing pneumonia, hospitalization and even death from flu- or pneumonia-related complications (Cohen et al. 2011; Reichert et. al 2001). A study done on vaccination of children in Japan showed that for every 420 children vaccinated, one influenza-related death was prevented (Reichert 2001). For this project, our objective is to increase the amount of children getting vaccinated through School Located Influenza Vaccination Clinics (SLIVs). SLIV clinics are conducted through the Tacoma-Pierce County Health Department (TPCHD), where every year they receive a certain amount of free influenza vaccines from the Vaccines for Children Program (VFC) and distribute it for vaccination in schools through volunteer organizations such as the Medical Reserve Corps (MRC). However, participation in these clinics is quite low, so in order to increase participation in school-aged children, we chose to look into the factors that affect their involvement in these clinics. In order to do this, we conducted a review of the literature about parental beliefs and behaviors regarding health care, and then conducted interviews with school nurses to gain insight into advertising, nurse and administration involvement, and staff attitudes towards school-located influenza vaccination. We found that nurse involvement and school advertisement played a large role in the number of parents who consented to the clinic.Based on these results, interventions will be implemented at low-participating schools with the goal of increasing the number of flu vaccinations occurring at these schools.

- Ramon Garza: See abstract for Abi Deleon

- **Desalination Concentrate Disposal: Ecological Effects and Sustainable Solutions**

  Ryan Hanley

  Capstone Advisor: Elizabeth Bruch

  Freshwater availability is a growing global concern, and desalination is often presented as the solution, but from this important technology comes issues of toxic waste. Ecosystems are delicate areas that contain species adapted to that specific location, and any chemical or physical changes can disrupt the fitness of species. The concentrate byproduct waste from desalination plants is toxic to species if the concentrate is not compatible with the receiving water body. A critical review of scientific articles, industry-leading books, conversations with industry experts, and information from the American Membrane Technology Association conference was used to analyze the current knowledge. Species health and environmental conditions are affected in both the long and short-term by chemical changes, such as an increase in salinity levels, which may be lethal or detrimental to growth. Desalination process types determine different chemical concentrations and physical characteristics, and depending on the receiving water body, the concentrate needs alteration to be compatible with the receiving water body. Solutions vary by location, but possibilities include beneficial ecological options that restore habitat water volume,

economic benefits that use the concentrate, and technical changes that blend the concentrate more effectively in surface water outfalls. Identifying the potential ecological issues from concentrate waste and developing sustainable practices before harm is caused will protect valuable ecosystems that connect all life on earth.

- Solomon Harvey: See abstract for Jacqueline Busby and Rachelle Ryken

- **Restoration and Adaption for Prospective Freshwater Shortages**

  Krystal C. Hedrick

  Capstone Advisor: Elizabeth Bruch

  The availability of water resources is a growing concern throughout the world as more populations experience severe water shortages. Restoration ecology seeks to repair damage done to ecosystems through anthropogenic actions and climate change, making it a possible long-term solution and adaptive strategy to water shortages. This paper explores the practice of restoration ecology to assess its ability to help people adapt to a future with water challenges. Research revealed that restoration ecology can be used to better prepare people for a future with water shortages. By adopting the Society for Ecological Restoration Australasia's National Restoration Standards, the efficiency of all types of restoration, including vital aquatic resource restoration, can be improved. The Standards could also help to redefine international restoration legally and be a basis for global standards. Emphasizing climate change adaptation through restoration in Tacoma water management documents would result in bold, proactive, cohesive and adaptive water management locally. Finally, collaboration between the Society for Ecological Restoration and the University of Washington Tacoma would connect students and faculty to a global network, and resources necessary to research, design and implement the most effective restoration techniques possible for an uncertain future with water challenges.

- **Scanning Electron Analysis of Magnetic Particles from Bengal Fan Strata**

  Risa Hess

  Capstone Advisor: Peter Selkin

  Just as mountain-building from the convergence of tectonic plates changes weather patterns, the opposite, monsoons in southwest Asia, may have also influenced the erosion of the Himalayas. Turbidite sediments collected in International Ocean Discovery Program cores from the Bay of Bengal contain material eroded from the Himalaya, which may have

been shaken up during monsoon destruction then resettled. Magnetic particles extracted from those turbidites were tested for magnetic properties and identified using scanning electron microscopy. Magnetic minerals positively identified include magnetite and sulfides. Linking these minerals to their sources in rocks and soils from the Indian Subcontinent and the Tibetan Plateau, we will be better able to model the erosion patterns back from 14,000 years ago, potentially correlating heavy storm activity in one region to massive sediment deposition downstream. This data may suggest whether the erosion from weather over a long period of time creates a negative feedback loop causing more intense climates overall. Further data that refines the ages of sediment layers can also relate how the severity of storms affects the increase in mountain erosion and runoff.

- **Mount Rainier National Park: A Shuttle Location Analysis**

  Taylor Hewett

  Capstone Advisor: Matthew Kelley

  Mt. Rainier National Park receives millions of visitors each year. The high volume of visitors within this park leads to an abundance of vehicles entering the park. These vehicles overflow the parking lots and often park illegally along roadsides. With this analysis I have designed a shuttle route with designated stops at commonly visited areas. The Network Analysis Tool within ArcMap 10.4.1 was used to generate a model that includes stops at designated service areas that include hiking trails and visitors attractions within a five minute walk from the road. The result is a route from the Longmire entrance of Mt. Rainier National Park near Ashford, Washington to the South Eastern Ohanapechosh entrance. The proposed route has 18 stops and would run a total 38 miles one-way. If this route was enacted, traffic, parking issues, and underlying environmental damage could be reduced. Further analysis could include breaking this shuttle route up into multiple routes to create a transit system that would keep rider wait times below 25 minutes.

- Gerald Hilario: See abstract for Kokou Dogbe

- **Linear Optimization and the Simplex Method**

  Emily M. Hoang

  Capstone Advisor: Julie Eaton

Mathematical optimization is an area of mathematics concerned with finding the maximum or minimum value of a function subject to constraints. Linear optimization, or *linear programming*, is an important area of optimization with a rich history. We will define a general linear programming problem and examine standard and canonical forms, which are written formats for *linear programs*. Next, we explore the geometry of the simplex method, a computational technique for solving linear programs developed for a U.S. military commission in the 1940s. Finally, we consider the following problem: given a cargo airplane and four types of cargo, how should each cargo type be distributed on the airplane to maximize profit? We answer this question and illustrate how to model the problem as a linear program.

- **Global Impact: Urubamba, Peru A Trip of a Lifetime!**

  Mato Hongo and Amanda Lee

  Capstone Advisor: Erica Cline

  Every now and then we hear about studies of a break through on diseases or illnesses, but those aren't the only things that underdeveloped countries need. Healthcare is a major issue and what can lead to healthcare issues may come from everyday household objects such as water filters and stoves – the two necessary commodities most people have today, but not everyone can afford in developing countries. In developing countries there is a lack of sufficient sanitation practice and economic variables which prevents communities from having access to stoves and water filters. Strategies to provide the basic needs such as clean water and cooked food vary by countries' economic and social norms. A practical solution can be achieved by introducing cheap and renewable options such as the Ceramic Water Filter (CWF) and Ceramic Stove. An assessment to providing a sustainable solution in developing countries will require communities to achieve a complete understanding of CWFs and Ceramic Stoves as proper usage and decommission method have significant impacts on their safety, health and lifestyle.

- **Goats for Lawn Maintenance and Therapy for Student Stress**

  My Huynh, Rachel Fladager, Brandi Singleton, and Hali Siegert

  Capstone Advisor: Kim Davenport

  Goat landscaping has been on the rise for the last ten years, becoming a demand with larger companies such as Google, metropolitan areas and colleges. Both UW Bothell and Seattle have employed herds for land clearing projects. Goats are considered to be a great choice for sustainable vegetation management around campus to reduce the CO2 emission from gas-powered mowers. In addition, goats can offer stress relief for the UWT

community. Inspiration for this project was the use of goats on college campuses here in UWT for stress relief during “dead week” and to reduce the main concern of carbon dioxide emissions from gas-powered mowers on campus. However, we have determined that it is not feasible at this time to use goats for vegetation management around the UWT campus. We found this to be largely due to two reasons: one is that the presence of hazardous materials on the vacant lots prevents implementation until cleaned up; and other is that information about permits and cost are currently pending. Any costs found may be compensated by reduced gas use and equipment repair. While we may suggest viable goat businesses, Facilities Services should address persons caring for hazardous material as it is much more specific and volunteers are unqualified.

- Tatiana Hyldahl: See abstract for Andrew Boupha

- Melissa Jimenez: See abstract for Mylissa Bowlin

- **Activity-Dependent Localization of Presynaptic Glutamate Receptor-Interacting Protein 1 (GRIP1) Concomitant with Homeostatic Plasticity at Cortical Synapses**

  Jaime Kelleher and Marc Nahmani

  Capstone Advisor: Marc Nahmani

  Monocular deprivation (MD) is a canonical paradigm wherein one eye is closed, and the state of deprivation-induced neuronal plasticity is assayed over time in primary visual cortex.MD induces a drop in neuronal activity after a brief (two to three days) period of deprivation, followed by a homeostatic rebound in neuronal activity back to baseline levels by 6 days of deprivation.Neuronal homeostasis is a critical plasticity process that allows neuronal circuits to maintain fidelity of information flow despite constant changes in environmental stimuli. However, how neurons in primary visual cortex achieve this homeostatic rebound in excitatory activity remains poorly understood.Glutamate receptor-interacting protein 1 (GRIP1) is a PDZ domain-containing AMPA receptor binding protein necessary for homeostatic scaling of neuronal synapses (Gainey et al., 2015, Tan et al., 2015), and is thought to perform this role by recruiting and/or binding AMPA receptors at the postsynaptic density. Our preliminary results show that after 3 days of MD neuron expression is depressed, leading to a significant increase of GRIP1 in the presynaptic bouton. After 6 days neuron firing is recovered to normal base line levels, and there is a significant decrease of GRIP1 in the presynaptic bouton. This leads us to two hypotheses: GRIP1 may be inhibiting presynaptic release of glutamate, acting as a ‘homeostatic sensor’ to uncorrelated activity, or, GRIP1 could be disinhibiting presynaptic release in an attempt to return the neuronal activity back to baseline.

- Jessica Kelsey: See abstract for Shannon Black

- **Bathymetric Clones with Drones: Self –similarity in Two Lacustrine Deltas**

  Katie Kennedy, Dan Shugar, and James Best

  Capstone Advisor: Dan Shugar

  Various mechanisms influence regional sediment accumulation in Kluane Lake, Yukon, Canada. We examine the two southern-most inflows to Kluane Lake: Slims river and Silver creek both of glacial origin. We compare bathymetric profiles of the deltas, collected using a cutting-edge multibeam sonar mounted in an Unmanned Surface Vessel. Both Slims River and Silver Creek deltas exhibit unusual terraces that are unlikely to represent former lake level low stands. Similar terraces have not been observed at other lacustrine locations in the world, to our knowledge. At this time, it is unknown whether the scalloped landforms are strictly hydrologically influenced or
  if other factors contribute to their development.

- Jess Kern: See abstract for Andrew Boupha

- **Tracking the Spatial Distribution of Olympia Oysters (*Ostera lurida*) in Fidalgo Bay, WA**

  Suji Kim, Bonnie Becker, and Michelle McCartha

  Capstone Advisor: Bonnie Becker

  Olympia oysters (*Ostrea lurida*) are the only native oyster species in Washington State. Over the past 100 years populations have dwindled, but due to restoration efforts, Olympia oysters are slowly recovering. So far there is limited information about the behavior during the larval stage. Previous observations suggest that larvae would be more abundant at the surface compared to the bottom of the water column. In this study, we measured the spatial distribution of larvae at surface and bottom depths in Fidalgo Bay, WA during the Summer of 2013. Plankton samples were taken from 4 intertidal and 2 subtidal stations pumping 100L of seawater through a 75 . Olympia oyster larvae were identified using light microscopy, measured for shell height and length, and tallied to determine abundance and distribution. As predicted, larvae were not randomly distributed across the bay, and more larvae were found at the surface for each site. We found an order of magnitude of more

larvae at surface depths during ebb tide, indicating that larvae are being transported out of the bay. These results are being combined with additional temporal and spatial sampling, as well as environmental data, to fully describe the larval distribution of oysters in the bay. This study will improve restoration efforts as well as inform researchers and local communities about the early life stages of Olympia oysters.

- Adam Knyaz: See abstract for Charles Campbell

- Amanda Lee: See abstract for Mato Hongo

- **Effects of Hatchery Practices on Steelhead Supplementation**

  Nolan Magee, Erik McDonald, and Clayton David

  Capstone Advisor: Erik McDonald

  Anthropogenic changes to river and ocean ecosystems, such as poor water quality and detrimental hatchery practices, have negatively affected the salmonid populations of the Pacific Northwest. Hatcheries have been tasked with supplementing existing populations in order to ensure thriving, natural runs of wild fish. Successful supplementation is difficult to achieve as non-selective bred fish raised in captivity are vastly different than their wild counterparts. This study tests the effectiveness of new hatchery practices designed to improve upon traditional practices that have had a negative effect on existing and future steelhead generations. Steelhead (*O. mykiss*) eggs were retrieved from rivers located in Hood Canal rather than fertilized in a hatchery setting and were raised for two years rather than the traditional one year. Steelhead were sampled from two control streams and one supplemented stream in order to determine if the change in technique is indeed beneficial and results in a stronger population. The affiliated data is still being collected and will be present for the final poster.

- Ilianna McDaniel: See abstract for Sehar Bokhari

- **Let's Get Less Wet**

  Duncan McPherson, Alebachew Shiferaw, and Dwitiya Putera Hentyarsa

Capstone Advisor: Kim Davenport

The purpose of our project is to reduce the amount of wasted water used in the restrooms around the UWT campus. Three quarters of the planet is covered in water. However, 98% of that water is salt water, which we cannot drink (waterinfo.org). So, it make sense to try and use as little as possible of the 2% that we can actually drink. We propose the implementation of the state of the art "instant-off" faucet system and low flow 1.1 GPF(Gallons per Flush) toilets. The instant off system is a zero waste water system because it only turns on when you push the rod, then instantly turns off when you take away your hands. These also reduce the risk of cross contamination and other health risks. There are three series of the instant off faucets; the home series, the pro series, and the faucet series. And the best part is, they are very cost effective to purchase and installation is extremely easy. Tacoma has put it automatic sensor faucets and water efficient low flow toilets, but only in the high traffic restrooms; probably because these are very costly. But we have heard that some of these faucets will stay on and the sensors run on electricity and the maintenance has the potential to be costly. Because our proposed faucets produce zero waste water, are very cost effective, and the toilets will reduce the amount of water used per flush, the UW Tacoma community will back our proposal.

- **The Effect of Relative Water Flux on Collection of Olympia Oyster (*Ostrea lurida*) Larvae**

David Mullins, Bonnie Becker, and Michelle McCartha

Capstone Advisor: Bonnie Becker

Olympia oyster (*Ostrea* lurida) populations in Washington State have been decreasing since the early 1900s due to overharvesting, poor water quality, and habitat loss. The purpose of our research is to help the restoration efforts of the sole native oyster in Washington State. Sample collection took place in Fidalgo Bay, WA during the summer of 2013. This portion of the larger study was done to compare water flows at different depths and stations in the bay to determine its effect on larval dispersal. Larval tube traps, made from clear shipping tubes, were placed at seven stations throughout Fidalgo Bay. Attached to each trap was a 7.6 cm-diameter calcium sulfate "puck", which was painted on the sides and bottom, leaving only the top exposed to the water. We measured the relative water flux at each trap by weighing each puck before placement, then dried and weighed again after removal from the field to determine the change in mass. The change was used as a proxy of relative water flux at each site and depth. The hypothesis was that more water flow would result in more movement of larvae through the water and into the tube traps. We found that the traps along the surface of the water experienced a heavier water flow than the mid-level and deep traps. Also, the traps along the surface contained more Olympia oyster larvae than those at greater depths. Tracking the Olympia oyster larval distribution will aid restoration efforts in Fidalgo Bay.

- Diamond O'Neill: See abstract for Sehar Bokhari

- **Spinule Prevalence at Postnatal Day 43 in Excitatory Cortical Synapses**

  David Onyali and Marc Nahmani

  Capstone Advisor: Marc Nahmani

  We were interested in studying the ultrastructure of the neuronal synapse, observing changes in the brain as a person ages. For this study, several brain scans of neurons (nerve cells) and glia (brain tissue) from transmission electron microscopy ranging from infancy to adulthood were examined on the image analysis program FIJI for the junctions between the neurons called synapses, and small thorns called spinules which can form from postsynaptic densities on the postsynaptic membrane. For each image, the number of presynaptic neurons sending signals and postsynaptic neurons receiving signals, synapses, and spinules (if any) were counted up. The results showed an initially small number of these synapses that gradually increased, along with the presence of spinules, as the age of the brain rose. This indicates that the brain continues to become more complex after early childhood.

- **Population Size and Marine Survival of Steelhead in Supplemented Hood Canal Streams**

  Mackenzie Partridge, Erik McDonald, and Clayton David

  Capstone Advisor: Erik McDonald

  Puget Sound steelhead, *Oncorhynchus mykiss*, have been listed as a threatened species under the ESA. The depleted Puget Sound stocks have been supplemented by traditional steelhead hatchery methods, which serve to provide harvestable fish. These hatcheries release steelhead smolts as yearlings and have the consequence of increasing residualism rates and selecting for domesticity, both of which contain ecological risk. With the goal of conserving and rebuilding depleted steelhead stocks, unique hatchery techniques, which aim to avoid the negative impacts of traditional hatchery methods, were conducted in Hood Canal supplemented streams. These hatchery techniques include pumping redds and collecting eggs from steelhead that breed in situ, allowing for sexual selection, then releasing smolts at age two. The demographic impacts of conservation hatchery techniques were analyzed by comparing the population size of steelhead in the Dewatto, a hatchery supplemented stream, to steelhead from the Tahuya and Little Quilcene, two unsupplemented streams in the Hood Canal. Marine survival rates, which limit the

productivity of steelhead stocks, were also compared for the 2014-2016 and 2015-2017 cohorts. These results will be included upon completion of data collection.

- **Healthcare Abroad – Observations at a Medical Clinic in Keta, Ghana**

  Claire Posadas

  Capstone Advisor: Erica Cline

  Living in the United States sometimes clouds the realization that there are easily preventable and treatable diseases contributing to the death of millions of people every year. While there has been tremendous headway in decreasing global morbidity and mortality rates from these diseases, there is a long way to go before every human being has an equal chance at a healthy and prosperous life. Ghana, West Africa is one country in particular that has struggled to provide its citizens with equal access to quality healthcare. There has been great improvement within their healthcare system in recent years, however malaria and tuberculosis still remain among the leading causes of death: two diseases that are scarcely seen in the United States and other economically developed countries. I had the amazing opportunity of participating in a service-learning trip to Keta, Ghana in August 2017. I observed the clinic staff as they provided services centered around child-welfare, curative services, and family planning. During that time, I had a first-hand look at how a medical clinic is managed in another country. There were many aspects of the healthcare system in Ghana that were very effective, however it was quite evident that there is a lack in healthcare professionals and resources which is leading to a lack in early diagnosis and prevention of diseases. I am so grateful I was able to travel to Ghana because it allowed me to strengthen my cross-cultural communication skills, discredit uneducated stereotypes I had about West Africa, and most importantly build life-lasting relationships. This trip also reaffirmed my aspirations of one day pursuing a career in healthcare abroad.

- **PCR Assay of Foreign DNA (Periplaneta Americana and D. Melanogaster) in Consumer Chocolate**

  Adam Prince, David Hirschberg, and Judy Nguyen

  Capstone Advisor: David Hirschberg

  Asthma and allergies are two of the most common ailments that affect those that cannot consume chocolate. Studies have suggested that allergies play a role in the inability of those who cannot consume chocolate often resulting in asthma attack. Other studies suggest it is not chocolate that these individuals are allergic to. Instead it may be the contents of arthropod parts found within chocolate after processing. The US Food and

Drug Administration allows no more than 60 insect parts per 100g of chocolate. As a result this study aims to identify the possibility of insect contamination via PCR to find American Cockroach (*COI subunit 1* and the Fruit Fly(*Drosophila Melanogaster*) *COX5a* genes in high content (80-90%) cacao processed chocolate bars. These two genes are highly conserved in a majority of arthropods with single nucleotide polymorphisms allowing for variation in this study. Preliminary results have been to align designed primers to synthetic DNA for each specific gene and its corresponding organism. Success has been achieved in ligating synthetic DNA to the vector pSB1C3 and ensuring designed primers are efficient to identify the two genes of interest.

- **Oviposition Habits of the Seed Beetle**

Natalie Ries

Capstone Advisor: Jeremy Davis

Insect egg-laying decisions can be critical for the survival of offspring, and research on these decisions is crucial to understanding insect ecology and management. Seed beetles distribute their eggs across seeds to minimize competition amongst their larvae and prefer seeds without previously laid eggs. In this study, we tested the factors influencing the ability of beetles to optimally distribute eggs across hosts with hopes of predicting the potential of this pest to spread to additional hosts.

In our first experiment, we asked whether beetles could discriminate between seeds with old vs. new eggs. We learned there wasn't a significant difference in the number of eggs laid on seeds with new eggs or old eggs.

In our second experiment, we asked whether the ability of beetles to optimally distribute eggs across seeds of differing size depended on the host species. We tested beetles on 4 species of bean; 2 normal host species, and 2 hosts not used by beetles in the wild. *C. maculatus* showed the expected preference for larger beans in both normal hosts and one novel host. Future experiments will explore whether the distinct flattened shape of the Lima bean, relative to the spherical shape of the other 3 species is responsible for the inability of beetles to use it optimally as a resource.

- **Opening Doors: Vestibules at UWT**

Zoe Ruggiero-Diehl, Alyse Lippert, and Sabrina Brentin

Capstone Advisor: Kim Davenport

The University of Washington Tacoma has made a commitment to adhering to the sustainability standards set by the Leadership in Energy and Environmental Design (LEED) and have made great strides with the Russell T. Joy building achieving platinum status. However, there are still many improvements that can be made to make this campus more sustainable. One of those improvements is heat conservation. As a heavy traffic area, many buildings lose heat due to the opening and closing of doors. We therefore need a feasible sustainability solution that will provide benefits that outweigh the costs. Installing vestibules will not only conserve heat, but it will also save money in the long-term. Our challenge is to find the ideal location for a vestibule and provide sufficient evidence of its importance to the administrators at UWT. To accomplish this end, we surveyed each campus building and evaluated each location based on the requirements for outfitting a building with a vestibule. We concluded through our research that the BHS building would be an ideal location for installing a vestibule.

- Amira Salim: See abstract for Abi Deleon

- Dahlia Salim: See abstract for Abi Deleon

- **Isolation and Analysis of Sialylated Antibodies for Blood Brain Barrier Efflux**

Amira Salim, Daliah Salim, and John Finke

Capstone Advisor: John Finke

Alzheimer's Disease (AD) is the most common type of dementia, with symptoms of memory loss and cognitive impairment. It affects approximately 36 million people worldwide and this population of individuals with neurodegenerative diseases is estimated to increase threefold over the next 50 years. Highly specialized Endothelial cells of brain capillaries are the primary anatomic units of the blood-brain barrier (BBB), that support its functions. It acts as a diffusion barrier, transports substances in and out of brain. The neurodegenerative diseases such as AD require drugs to pass the BBB, however, their penetration into the brain is low and drugs don't reach its full potential of use.

Research from the Finke lab on sialylated antibodies suggests sialic acid can prevent the efflux of IgG across the blood-brain barrier. However, these studies used relatively low sialylation levels (~14%). To enhance the effect, we explored affinity chromatography with a sialic acid-specific protein (SNA) to enrich the sialic acid levels. Our first attempt purified SNA specific antibodies but their binding was not due to sialic acid. Our subsequent attempts were able to purify antibodies that bound SNA with sialic acid. These

samples will enable key blood-brain barrier experiments with sialic acid enriched antibody preparations.

- Jazmin Sanchez: See abstract for Sehar Bokhari

- **Effects of Hatchery Supplementation on Steelhead Smolt Abundance in Hood Canal**

  Erica Shanahan, Erik McDonald, and Clayton David

  Capstone Advisor: Erik McDonald

  Populations of native steelhead (*Oncorhynchus mykiss*) in the Hood Canal have been declining for a number of years and the species is currently listed as Threatened under the Endangered Species Act. These declining numbers can have impacts for humans both from an economic and cultural standpoint as well as impacts for other organisms that rely on the fish for food or other ecological services. Although hatchery supplementation has been proposed as a solution to improve the abundance of steelhead, previous studies have found that the introduction of hatchery fish can lead to negative impacts on native populations. This study aimed to improve upon hatchery practices by mirroring natural population life histories. Traditional hatchery practices obtain gametes from selected fish, artificially spawn them in the hatchery, and then release the smolts at age 1. For this study, embryos were collected from redds, reared in a hatchery, and released at age 2 to reflect the native steelhead migration patterns. The smolts were released into the Dewatto stream in Hood Canal. Two additional streams were used as controls. Screw traps were used to estimate population abundance in three streams. Data were collected daily from April 1 through June 1 2018. Results of freshwater survival of steelhead in the supplemented versus control streams will be discussed in detail at the time of presentation.

- **UW-REN Titlow Beach Park**

  Justin So, Noah Wingard, Patricia Gilliland, Nermala Krishna, and Robert Wright

  Capstone Advisor: Cynthia Updegrave

  Titlow Beach is a well-known public park that provides an important inter-tidal wetland and Puget lowland forest along the Puget Sound. Our site has also provided the UWREN program through the University of Washington Tacoma the ability to plan successful restoration projects in an environment that is important to the region. Despite its ecological importance, invasive flora such as English ivy and Himalayan blackBerry have encroached upon native plant species and competes for growing area and soil nutrients. Our team

removed invasive plant species, utilizing simple hand tools and mulch for soil insulation, along the north eastern edge of the park. Native plant species such as Western red Cedar, Grand fir and trailing blackberry were planted in areas where each species could best thrive according to soil content, moisture and sunlight. Restoration over this past academic year has been successful, and with further stewardship and engagement from our community partners, this section of Titlow Beach parks can continue to provide the ecological systems native to our region. We look forward to continuing bringing the academic goals and achievements of UWT to fruition on our site through community support as well as steward the regrowth of the native environment.

- **What's the Best Way to Look at Fire Security and Predict Tree Mortality?**

  Sathoun Sok and Maureen Kennedy

  Capstone Advisor: Maureen Kennedy

  High abundance of fuel loadings, trees, and dry forests within Western United States, are prone to high rates of fire ignition and severity. Wildfire data taken from 2014 Bald Fire from NE California, were looked at for the effectiveness of fuel treatments in treated and untreated sites by comparing fire severity (bole char height), measures of tree size (diameter, height, crown ratio), topographic characteristics (elevation and slope), and canopy cover. The relationship between various combinations of the identified variables are explored in RStudio to determine which variables are good indicators/predictors of fire severity using multiple linear regression and logistic regression. Results revealed that bole char height (BCH) was not a good indicator when comparing the two sites on fire severity since BCH depends greatly on the actual height of the tree. Significant relationship was found for BCH only when looking at the combination of tree diameter and height. Looking at the log-odd success rate of 100% crown scorch; significant relationships was found among combined effects of crown ratio, canopy covers, and topographic characteristics. Further exploration of the models presented may improve by looking at the effects of individual variables rather than a combination of variables to predict fire severity. Any additional contributing factors that could be identified shouldn't be ignored but be explored further to expand models that will contribute to the explanation of the complexity presented in the 2014 Bald Fire.

- **Analysis of Microplastics in the Puget Sound**

  Brenda Solano and Julie Masura

  Capstone Advisor: Julie Masura

Microplastics have recently become an issue in the Puget Sound. Microplastics are defined as being plastics that are 5.00 mm or smaller in size. These particles are found in various bodies of water such as lakes, rivers, oceans and seas. There are two main ways of how microplastics enter bodies of water, one is through the runoff of degraded plastics and the other through the small manufactured microplastics. Although the side effects are unknown to harm marine wildlife, marine wildlife have been ingesting these small particles that are not visible to the naked eye. The components of the microplastics contain chemicals that may cause side effects, which is why we are analyzing microplastics throughout the Puget Sound. All samples contained fibers from 2 to 24 fibers per sample.

- **The Afflictions of Fruit Trees in Tacoma's Giving Garden**

  Janessa Spurgin and Cynthia Updegrave

  Capstone Advisor: Cynthia Updegrave

  Washington State is well known as the apple-capital of the United States. Despite these non-native fruit bearing trees being able to adapt to Washington climate, the rainy weather and native pests can wreak havoc if not managed. Apple and other fruit trees are common fixtures in home and community gardens that help with urban food security. To treat and prevent disease and pests that could be affecting the fruit trees' production and those that are most likely to affect them in future seasons, the biotic and abiotic factors were identified, then the most effective environmental and non-chemical gardening techniques were analyzed to determine the feasibility of implementation and long-term use in urban gardens.

- **Use of Science Within Collaborative Partnerships: Study Design**

  Sara Stewart, Austin Sell, Tom Koontz, Craig Thomas

  Capstone Advisor: Tom Koontz

  Degradation of ecosystems has reduced the sustainability of resources that organisms and humans rely on. Recovery efforts and plans help to restore and maintain ecosystems so future generations can enjoy them as we do today. In the Puget Sound, there are many collaborative watershed partnerships that help to facilitate these ecosystem recovery efforts and assist in guiding the creation of ecosystem recovery plans. These partnerships are not scientific bodies, but they may try to use science to help promote ecosystem recovery efforts within their own organization and communicate these decisions to the general public. We know a lot about how collaborative partnerships are created, structured, staffed, and what activities they pursue, but we know very little about how different types of collaborative partnerships utilize science in their decision-making process. A multitude of

partnerships in the Puget Sound in Washington State were contacted and asked if they would like to participate as focus groups. Interviews were set up and conducted using a set of questions pertaining to science usage in these collaborative partnerships. Their responses were to be recorded, transcribed, and analyzed using qualitative data analysis.

- **Growing the Garden: Utilizing the UWT's Community Garden**

  Rachelle Ryken, Rebecca Dever, Solomon Harvey, and Tanner Stillwell

  Capstone Advisor: Kim Davenport

  The University of Washington Tacoma is under-utilizing the Giving Garden which serves as its community garden. This is creating a plot of land that is a waste of space and revenue. Throughout this project, a group of UW Tacoma students, went to the Giving Garden and decided that it needed to be cleaned up and utilized. Afterwards, we realized that there was really only one individual using the Giving Garden and they were no longer a student at the University. This plot of land can be used as a teaching tool for individuals who are interested in many different courses. After researching what kinds of courses could use the Giving Garden, we found that there could be botany, community outreach, and even some business classes if we had a functioning garden. This research was found from Highline College and Harvard University, which both have working and functioning community gardens. These colleges have classes and internships that help make sure their community gardens are used and give back to the community. The school needs to make an effort to utilize this Giving Garden, as it is an opportunity to give back to the community and help students learn valuable life skills.

- Tanner Stillwell: See abstract for Rachelle Ryken

- **Arsenic Inputs and Outputs of Urbanized Lakes in the Puget Sound**

  Natalia Stilnovich and Jim Gawel

  Capstone Advisor: Jim Gawel

  High levels of arsenic are in Puget Sound lakes due to the ASARCO smelter, located in Ruston, WA. This smelter, in operation for over 100 years, spread metal pollution throughout the region via atmospheric deposition (Figure 1). All smelting stopped in the 1980s, but arsenic remains in contaminated lake sediments and watershed soils. The ongoing transport of arsenic, other metals, and nutrients to and from these lakes is not measured currently, and is an important component of mass balance models needed to

understand the fate of these contaminants. Our study examines the levels of arsenic, heavy metals, and nutrients flowing in stormwater and streams into and out of these contaminated urbanized lakes: Angle, Steel, Killarney, and North Lakes. We used collection sites from storm drains and streams connecting with the lakes. Stream flow measurements were taken, and water samples were collected for metals and nutrients. Citizen volunteers were recruited to collect additional water samples using a provided collection kit during storms. Results will be finalized during summer 2018.

- Katelyn Tozer: See abstract for Andrew Boupha

- **Mapping the Susceptibility of Alders to Phytophthora alni in Western Washington**

  Brandon Voelker

  Capstone Advisor: Peter Selkin

  Chlorinated ethenes are toxic chemicals used in degreasing and dry cleaning, and their improper disposal can result in contamination. Affected sites should be assessed to determine the methods of remediation. Magnetic susceptibility is a measurement of a substance's ability to be magnetized when put in a magnetic field. Magnetite, a common mineral with the formula Fe3O4, is strongly magnetic and has a high average susceptibility. Indeed, magnetite can dominate the magnetic properties of Earth materials such that magnetic susceptibility can be used as a proxy for magnetite abundance. Soil contaminated with chlorinated ethenes has several biotic and abiotic degradation pathways. One abiotic pathway is through magnetite, which is known to affect the detoxification of this pollutant. Choosing the best pathway is aided by the software tool BioPIC. In this study, soil was analyzed using a protocol developed for frequency-dependent discrete specimen magnetic susceptibility measurements to determine magnetite content, and thus to estimate ethene degradation rates. Frequency-dependent measurements allow for estimating magnetite particle size, which influences reactivity. A further avenue for research in the future would be to discern the source of magnetite in the soil, whether it is transported by water or air, precipitated from chemical solutions, or synthesized by certain bacteria. Abiotic degradation of ethenes is just one parameter to consider in an overall remediation strategy. Options for remediation include removing and disposing of the affected soil, containing the soil in place, aerating the soil, and using microorganisms to digest the pollutant.

- Johanna Wilson: See abstract for Brandon Brooks

- Noah Wingard: See abstract for Justin So

- **Incentivizing Carpooling at UW Tacoma**

  Robbie Wood

  Capstone Advisor: Kim Davenport

  Incentivizing carpooling at University of Washington Tacoma would reduce emissions released by commuting to campus, save commuters money, and help solve the current parking crisis. Promoting carpooling with incentivization (in the form of reduced parking rates) among students, faculty, and staff would require a method to enforce carpooling and ensure that only carpoolers receive the benefits. This project included research of other campuses' carpooling programs, such as UW Bothell and Monash University, and a survey of UW Tacoma students, faculty, and staff. Research showed that some campuses, such as UW Bothell, use reduced carpooling parking permits while others like Monash utilize free carpool parking lots. The majority of those surveyed said they would be more willing to carpool if reduced parking rates were offered. This project determined the best way to promote carpooling at UW Tacoma is to provide reduced parking rates as an incentive. The survey data also showed that there is a demand at UW Tacoma for a carpooling program for students, faculty, and staff using a quarterly permit system. As UW Tacoma continues to expand in the long-term, the school should consider dedicated carpool parking lots to effectively promote and enforce increased carpooling.

- **New Road to be Healthy: A Proposed Bike Lane**

  Wuhui Zhang, Longwai Lui, and Sam Wensley

  Capstone Advisor: Kim Davenport

  The City of Tacoma has an infamous reputation for worse than average air quality across the country. Part of the problem can be blamed on lacking in more diverse transportation options. Our proposal, as a student in University of Washington Tacoma, is building a dedicated bike lane for people on campus to use instead of driving to school since by having such bike lane will encourage more students and staffs start biking and reduce the risk associated with biking along the way. The proposal includes where and how wide the bike lane will be on campus; furthermore, necessary infrastructures that are need for bikers, such as bike storages, repair stations, and outdoor water fountains. Our conclusion would be possible to complete in a short time; however, a comprehensive infrastructure is needed to support a full on biking life.