UNIVERSITY of WASHINGTON

Undergraduate Research Symposium May 18, 2018 Mary Gates Hall

Online Proceedings

POSTER SESSION 1

MGH 241, Easel 152

11:00 AM to 1:00 PM

Reviewing and Optimizing Chromatin Conformation Based Genome Assemblers

Alisha Jenae Mc Nett, Senior, Biology (Ecology, Evolution & Conservation)
Shourya Jain, Junior, Computer Science
Mentor: Aakash Sur, Biomedical and Health Informatics
Mentor: Peter Myler, Pediatrics

As the field of genomics continues to grow, there is an overwhelming need for robust ways to assemble entire genomes, yet there is little guidance on what software best achieves this goal. An assessment of available genome assemblers is needed to improve assembly procedures. Genome assemblers output draft assemblies consisting of DNA scaffolds that are permeated with errors inherent to sequencing data, like wrong number of repeats, misjoins, inversions, missing sequencing, and extraneous sequences. These draft assemblies can then be input into an experimental assay called HiC that attempts to fix and orient the assemblies by taking into account chromatin contact interactions to elucidate genome architecture. The resulting genome is then more accurate and useful for research purposes. However, given the plethora of genome assembly and HiC software available, navigating each available software is time consuming and often requires extensive testing before actual use can begin. To improve this process, we aim to review several HiC scaffolding software tools for performance and quality, and fine tune their parameters for optimized outcome. This will allow us to suggest which software work best for a range of genomic data as well as provide summary statistics and accuracy measurements for each genome assembler tested. We tested several genome assemblers, including GRAAL and SALSA, which utilize HiC libraries to scaffold draft assemblies. After being produced and corrected through assemblers, these assembled genomes can then be used to advance research in functional genomics, genetic epidemiology, and many other fields reliant on genomic data. It is our goal to improve genome assembly procedures so that more researchers can use open source software to build and understand entire genomes and further the field of genomics.

POSTER SESSION 3

MGH 241, Easel 159

2:30 PM to 4:00 PM

The Influence of Urban Runoff on Coho Salmon: Removing Organic Contaminants from Storm Water

Sarah Marie White, Recent Graduate, Environmental Science, UW Tacoma
Mentor: Edward Kolodziej, Science and Mathematics/ Civil and Environmental Eng.
Mentor: Katherine Peter, Center for Urban Waters

River ecosystems depend on services salmon populations provide. Coho salmon, Oncorhyncus kisutch, supply valuable nutrients for mammals and birds and offer economic benefits for the Pacific Northwest. Salmon rely on water quality in freshwater streams during successful seasonal spawning. However, for over the past 15 years, research determined that urban stormwater results in the mortality of Coho salmon. Exposure to urban stormwater is toxic to Coho salmon, killing them in hours. This phenomenon is known as pre-spawn mortality (PSM), and it kills salmon before they reproduce. If this phenomenon continues, Coho salmon could go extinct. Previous studies have linked highway runoff and pre-spawn mortality. However, they indicate that basic water quality parameters such as temperature and pH and "typical" stormwater toxicants such as metals and pesticides are not the cause of PSM. Current hypotheses point to an unknown organic contaminant that is linked to urbanization and is probably present from roadways or cars. Previous studies have also shown that bioinfiltration of stormwater through a mixture of sand and compost can protect Coho salmon. The goal of this study was to investigate removal of organic contaminants in a pilot-scale compost-amended bioswale (CABS). The pilot-scale CABS was based on a field-scale bioswale that is operated by WA DOT and located on SR-518. In this study, we developed methods to extract water with suspended sediment (whole water), as well as extract filtered water and total suspended sediment (TSS) separately. Whole water and filtered water were extracted by solid phase extraction (SPE), using Infinity®SPE cartridges. TSS was measured using EPA Method 160.2, and captured solids were extracted with methanol. Extracts were then analyzed by liquid chromatography-high resolution mass spectrometry. These methods were then applied to evaluate removal of organic contaminants in the bioswale, including performance at mul-

tiple hydraulic retention times.

POSTER SESSION 3

Commons West, Easel 40

2:30 PM to 4:00 PM

More and Larger Snowstorms: Big Fake News

Yi Alan (Alan) Zhang, Senior, Mathematics, Economics
Xinyue Li, Senior, Economics, Statistics
Yuqun (Azura) Tang, Senior, Economics, Statistics
Mentor: Peter Guttorp, Statistics

Recently, there seems to be news about blizzards striking East Coast cities nearly every year. However, most reports simply claim that the frequency and intensity of large snowstorms on the East Coast are increasing without providing convincing evidence. Are they telling the truth? We decided to statistically test if the frequency and intensity of large snowstorms in coastal North America have increased in recent years. In our research, we encountered many difficulties during the data collection and cleaning processes. For example, most cities only have records since around 1950 and the Canadian snow data are hard to clean. We first plot frequency of large snowstorms for each city and detected that there is actually a downward trend of snowstorm frequency in coastal North America. To further verify our finding, we also permuted the time-series data and performed permutation tests on the slopes of the linear regression of extreme snowstorm frequencies versus year. In our current progress, the permutation tests suggest that, for all East Coast cities studied, the hypothesized increases in annual frequencies of extreme snowfall are not statistically significant at any reasonable level of significance for looking at exceeding both the 75% and 90% quantiles of annual snowfall. Thus, our current results imply that the frequency of large snowstorms in many East Coast cities has not been increasing in recent years, which is different from the media claims.

POSTER SESSION 3

Commons East, Easel 84

2:30 PM to 4:00 PM

The Conundrum Relating Himalayan Mountain Changes With Climate Changes

Risa Anne Hess, Senior, Environmental Sci: Geosciences (Tacoma)
Mentor: Peter Selkin, School of Interdisciplinary Arts & Sciences

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.

POSTER SESSION 3

Balcony, Easel 91

2:30 PM to 4:00 PM

3D-Printed, Elbow-Driven Orthosis for Individuals with Limited Hand Function

Makoto Eyre, Non-Matriculated, Mechanical Engineering, North Seattle College
Karley Elisabeth Benoff, Senior, Mechanical Engineering
Mentor: Katherine Steele, Mechanical Engineering
Mentor: Keshia Peters, Mechanical Engineering

Upper- and lower-limb orthotic devices are prescribed for individuals who have partially lost motor control, such as stroke survivors or those with cerebral palsy, to assist with the stability and function of a limb. Unlike prostheses, devices available for those missing part of a limb, there are few current solutions available for upper-limb orthoses. As a result, options for users can be clunky, expensive, and hard to customize. The goal of this research was to further develop a 3D-printed elbow-driven orthosis that is inexpensive, adjustable, and helps users with impaired dexterity perform two-handed daily tasks. In comparison to traditional devices, which can cost hundreds of dollars, this orthosis can be assembled for approximately $30 predominantly because of the use of 3D printed parts. Originally designed for an individual whose seizure reducing brain surgery limited use of her left hand, this orthosis takes advantage of existing elbow range of motion to operate a clamp near the user's palm by using a cable extending from the elbow to the hand. Cable tension activates the clamp near the palm in two distinct ways, depending on chosen part placements; the cable can either voluntarily open the clamp, or voluntarily close the clamp with elbow flexion. To compare clamp activation methods, we conducted a study that evaluated muscle activity and time to complete activities of daily living using the adjustable orthosis. These results will help inform which device setting, voluntary opening or

voluntary closing, is easiest to control for common tasks and inform future device improvements. Participants involved in this study included individuals with impaired and unimpaired hand function. Through a continuous cycle of prototyping, feedback, and device modifications, we have created a customizable, affordable, 3D printed upper-limb orthosis that will be open-sourced to promote further innovation to support individuals with limited hand function.

POSTER SESSION 4

Commons East, Easel 69

4:00 PM to 6:00 PM

Measuring Magnetic Susceptibility in Chlorinated Soil to Determine Remediation Strategies

Brandon E. Voelker, Junior, Environmental Science, UW Tacoma
Risa Anne Hess, Senior, Environmental Sci: Geosciences (Tacoma)
Melissa Marie Brainard, Recent Graduate, Environmental Sci: Geosciences (Tacoma)
Mentor: Peter Selkin, School of Interdisciplinary Arts & Sciences
Mentor: Jennifer Wynkoop

Soil contamination occurs when human-made chemicals seep into the ground. It can have negative effects on human and animal health, pollute groundwater, and reduce crop yields. Chlorinated ethenes are toxic chemicals used in degreasing and dry cleaning, and their improper disposal can result in contamination. Before remediation to remove the contaminant happens, the affected site must be assessed. 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 Fe_3O_4, 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. We also explore other magnetic properties to more conclusively determine magnetite concentration. 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.