WHITMAN

21st ANNUAL

UNDERGRADUATE CONFERENCE

2019

Humanities & Arts | Natural Sciences | Social Sciences | Mathematics

Welcome to the 21st edition of the annual Whitman Undergraduate Conference. In the span of two decades, more than 3,000 students have shared their scholarship and creativity in this all-day, student-led event, a signature program of the college.

Over the course of 20 conferences, panel themes have ranged from “Race and Representation” to “Art Theory and Critique” to “Disease and Cure.” Poster sessions that capture student research in the natural and social sciences are a key component of each conference. This year, a record 69 students are presenting posters in Cordiner Hall.

The Undergraduate Conference is devoted entirely to student achievement. Participants represent every academic nook and cranny of the college. The projects in this program attest to the original work that Whitman students produce in their courses of study, senior theses, internships, fellowships, grants and study abroad.

Whitman College


UNDERGRADUATE
CONFERENCE
APRIL 9, 2019

SCHEDULE

Tuesday, April 9, 2019

Breakfast
Reid Campus Center | 8:15–9 a.m.

SESSION 1
9–10:15 a.m.

Morning Intermission
Hall of Science Atrium | 10:15–10:45 a.m.

SESSION 2
10:45 a.m.–Noon

All-Campus Lunch
Reid Campus Center | Noon–1 p.m.

POSTER SESSION
Cordiner Hall Foyer | 1–3 p.m.

SESSION 3
3–4:15 p.m.

Afternoon Encore
Reid Campus Center | 4:15–5 p.m.

MUSIC PERFORMANCES

Chamber Ensemble

10:15–10:45 a.m. at Hall of Science Atrium
(Morning Intermission)

AMY DODDS, DIRECTOR

Gwyneth Walker: "Short Set for String Quartet"
Brahms: String Quartet № 1 in C Minor
Abby Herrick, Jack Fleming — violin
Flora Klein — viola
Liam Dubay — cello

Jazz Ensemble I

Noon–1 p.m. at Reid Coffeehouse (All-Campus Lunch)

DOUG SCARBOROUGH, DIRECTOR

Taka Olds, Tyee Williams — alto sax
Daniel Leong — tenor sax
Perth Sethapanichsakul — baritone sax
James Bogley, Claire McHale, Nate Miller,
Gary Gemberling* — trumpet
Liam Twomey, Lukas Koester, Eva Sullivan,
Cello Lockwood — trombone
Finn Henell — bass trombone
Sami Braman — violin
Spencer Thulin — piano
Cory Cogley — guitar
James O'Brien — bass
Bornnie Kabongo, Koby Haigerty — drums
Dorothy Mukasa — vocals

Jazz Ensemble II

4:15–5 p.m. at Reid Coffeehouse (Afternoon Encore)

GARY GEMBERLING, DIRECTOR

Emma Beaver — alto sax
Ben Hickman — tenor sax
Nate Miller — trumpet
Kyle Fix — trombone
Peter Schane — euphonium
Karl Johnson — piano
Connor Tobin — guitar
Bassel Jamali, Peter Schane, Marco Thompson — bass
Noah Dunn — drums
Ashlyn Quintas — vocals

* faculty

PANEL SCHEDULE

BREAKFAST | 8:15–9 a.m. | Reid Campus Center

PANEL SESSION 1	Olin 138 | Media & Modern Times	Olin 129 | Computer Science I	Science 159 | Dark Matter & DNA
9 a.m.	Nina Sharp	Jules Choquart Pablo Fernandez Ben Limpich Rajesh Narayan Paul Milloy	Benjamin Cosgrove
9:15 a.m.	Jackie Greisen		Lindsay Saber
9:30 a.m.	Gabbie Webbeking	Kirk Lange Jack Stewart Melissa Kohl*	Henrique Ennes
9:45 a.m.	Celia Langford*		Alexander Shaw*
10 a.m.			
Coaches	**Erick Franklund**	**Matthew Schetina**	**Sarah Rothschild**

MORNING INTERMISSION | 10:15–10:45 a.m. | Hall of Science Atrium

PANEL SESSION 2	Olin 138 | Race, Hate & Trauma	Olin 129 | Computer Science II	Science 159 | Geologic Surveys
10:45 a.m.	Rachel Loe	Sage Levin Kai McConnell Sean Miller Mikaela Slade	McKenzie Elliott
11 a.m.	Bryn Louise Ema Di Fruscia		Keifer Nace
11:15 a.m.	Mickey Shin	Ben Adams George Ashley Cooper Lazar Nikhil Lonberg*	Laura Bedoyan
11:30 a.m.	Olivia Gilbert*		Cait Mazzoleni
11:45 a.m.			Christoph Suhr*
Coaches	**Mayrangela Cervantes**	**Ema Di Fruscia**	**Emma Cooper**

INTERMISSION AND ALL-CAMPUS LUNCH | Noon–1 p.m. | Reid Campus Center

POSTER SESSION | 1–3 p.m. | Cordiner Hall Foyer

PANEL SESSION 3	Olin 138 | Environmental Justice	Olin 129 | Modes of Behavior	Science 159 | Brain Matters
3 p.m.	Ellie Teare Claire Pinger Nick Rapp	Nicki Caddell	Natalie Mutter
3:15 p.m.	Kaeley Pilichowski	Cameron Conner	Maegen Martin Chelsea Day Jill Low
3:30 p.m.	Chloe Carothers-Liske	Bryn Hines	Katie Davie Natalie Thiel
3:45 p.m.	Amanda Champion*	Ashley Weibel*	Lauren Wilson*
4 p.m.			
Coaches	**Erick Franklund**	**Matthew Schetina**	**Sarah Rothschild**

AFTERNOON ENCORE | 4:15–5 p.m. | Reid Campus Center

* moderator

Science 100 Brattain Auditorium | Wild Kingdom	Kimball Theatre | Myth, Canon & Meaning	Reid G02 | History, Identity & Place
Sandy Hattan	Leo Lin	Flora Klein
Sarah Smith	Ethan Raffman	Ree Robson
Gareth Jones	Hannah Ferguson	Tyler Phillips
Anna Ripley*	Chloe Daikh*	Bassel Jamali
		Connell Boken*
Natalie Mutter	**Anthony Reale**	**Caroline Bauwens**

Science 100 Brattain Auditorium | Species, Evolution, Adaptation	Kimball Theatre | The Arts	
Willa Johnson	Claire Pepple	
Frankie Gerraty	Elsa Hager	
Thomas Meinzen	Nathan Krebs	
Abbey Dias*	Missy Gerlach*	
Lilly Calman	**Willa Johnson**	

Science 100 Brattain Auditorium | Plant Science	Kimball Theatre | Composers Studio	Reid G02 | Disease, Care & Cure
Liza Briody-Pavlik Ralph Huang	Bryce Weber	Aaron Rodriguez
Zaynab Brown	Kirk Lange	Chris Simpkins
Walker Orr	Cory Cogley	Molly Burchfield* Sienna Rahe
Ashley Person	Thomas Meinzen*	
Grant Gallaher*		
Natalie Mutter	**Anthony Reale**	**Caroline Bauwens**

POSTER SESSION

1-3 p.m., Cordiner Hall

GEORGE ASHLEY, Prediction of Political Affiliation in a Multi-Party System

Many sentiment analysis projects related to politics focus on classification within the American political system or on a simple yes-no question. Some have attempted to classify beyond a binary construct, finding differences within parties or providing more granularity to political distinctions. Ultimately, these analyses are based on the idea of a left-right spectrum. I present results of a classification system applied to Canadian politics, a multi-party parliamentary system. I gathered a novel data set consisting of tweets from members of Canada's Parliament and used previously published methods to build a model that identifies party affiliations in this system. I also identified political keywords that correlate with specific parties and can be used as identifiers in determining a user's affiliation.
Faculty Sponsor: Andy Exley

ALEX BEHRMAN, Modeling Hydroquinone Ring-Cleaving Dioxygenases with Synthetic Complexes

Ring-cleaving dioxygenases (RCDOs) are enzymes that cleave specific substrates, such as hydroquinones and catechols. These dioxygenases are found in various soil bacteria. They occur in enzymatic pathways that degrade the toxic substrates for purposes of metabolism. My research is a continuation of efforts to model hydroquinone ring-cleaving enzymes. I created a synthetic molecule that mimics the active site of the enzyme-substrate complex. The synthetic molecule was bound to an iron atom and then exposed to dioxygen, which integrated into the synthetic molecule causing dissociation of the hydroquinone substrate and breaking its aromatic ring. I performed spectral analysis of the complex prior to and during exposure to dioxygen in order to gain an understanding of the ring-cleavage process. This model complex strategy offers promising insights into the mechanism of degradation used by RCDOs. My future pursuits involve a study of the molecular structure of the enzymes' cleavage products.
Faculty Sponsor: Tim Machonkin

KRISTIN BRADY, Solar Wind Effects on Ion Temperature and Density in Mercury's Central Plasma Sheet

Mercury has a complicated, reconnection-dominated magnetosphere. Understanding the areas where plasma is found provides insight into how this complex system works. My poster focuses on Mercury's central plasma sheet (CPS), one of three main areas where plasma is found in the magnetosphere. Using data from the Fast Imaging Plasma Spectrometer (FIPS) on the MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) spacecraft, I analyzed measurements of the solar wind and planetary ions over orbital observations from March 2011 to April 2015. With MESSENGER's extensive observations of Mercury's plasma composition around the planet's space environment, I determined how the temperature and density of the ions in the CPS are connected to dynamics in Mercury's magnetotail and how they are affected by solar wind.
Faculty Sponsor: Andrea Dobson

YULI BUCKLEY, Repression of the Auxin Hormone Signaling Pathway in Corn by the REL2 Corepressor

The plant hormone auxin plays key roles in growth and development. Auxin is directly involved in the development of corn reproductive structures (ears and tassels). At the cellular level, responses to auxin are often regulated by repressor proteins. In maize, there are 16 auxin repressors and at least one corepressor found in developing ears and tassels, but their functionality and contribution to development is largely unexplored. To test the activity of these repressors, I recapitulated auxin response machinery in yeast cells, and used fluorescence to measure repression activity. Data from fluorescence assays show that the corn auxin repressors are functional and that each repressor influences the auxin response in a slightly different way. A further understanding of this auxin response machinery will enhance our knowledge of how to engineer plants.
Faculty Sponsor: Brit Moss

SHANE CASEY, Sediment Source Dependency of Dunes in Central Washington

The expansion of agriculture since the 1960s has dramatically affected the landscape of Central Washington. My research examines the effect of farm expansion on nearby revegetation of exposed dune surface, testing the postulate that active dunes require an exposed sediment source. Literature on the subject indicates that active dunes require continuous wind-blown sand and a sediment source to provide this sand. Working by the assumption that wind patterns have not changed, it may be that increasing farmland has reduced the availability of sediment sources.

Using historical satellite imagery of Juniper Dunes and Hanford Dunes, I measured the area of exposed sand and developed a regression analysis to demonstrate that dunes whose sediment source has been developed with agriculture will vegetate, while dunes with exposed sediment sources remain active.
Faculty Sponsor: Amy Molitor

ZACH CLARK, Investigation of Non-Native Substrates for Benzoate Dioxygenase

The soil bacteria *Ralstonia eutropha* B9 contains an arene dioxygenase enzyme that catalyzes the transformation of its native substrate, sodium benzoate, into a compound that has great potential as a building block for complex synthesis. I present an investigation of new substrates for the enzyme with quantification of these reactions (e.g., activity and productivity) via ^{1}H-qNMR spectroscopic analysis of resting whole-cell cultures. I explain how this method was developed and the manner in which it can be used, including to elucidate previously unknown trends in the substrate specificity of dioxygenase systems, and its ability to facilitate analysis of unstable reaction products.
Faculty Sponsor: Jon Collins

MEGAN COOKE, Material Culture Analysis of Unangan Artifacts from the Islands of Four Mountains, Aleutian Island Arc, Alaska

The Islands of Four Mountains (IFM) are tiny islands along the central Aleutians archipelago that were inhabited by ancient Unangan people 3,800 years ago. The IFM hold cultural material of prehistoric human occupation under continuously challenging conditions and limited resources. Archeological excavations of ancient villages intersected by beach cliffs have recovered stone tool artifacts. I analyzed samples from excavated cultural materials and surrounding lava flows using an FEI 250 Quanta environmental scanning electron microscope, obtaining images and compositional data in order to identify any mineralogical trends in lithic tool debitage. Identifying mineral trends in stone material collection provides perspective on the decision-making process of the Unangan in terms of any preference for a certain type of lava for tool manufacture. The results of my study will help determine whether the ancient Unangan people utilized the same stone resources during their time on the islands.
Faculty Sponsor: Kirsten Nicolaysen

WILL DOUCETTE, Developing ShadowAuxin: A FRET-Based Biosensor Utilizing a Quenching Fluorescent Protein

Auxin is a plant hormone essential for growth and development. Tracking auxin concentration in plants is essential to a broader knowledge of plant growth. I aim to build a biosensor that utilizes two proteins derived from jellyfish: one that glows green when illuminated by a laser, the other that can absorb and "quench" that green light and remain dark, via Förster resonance energy transfer (FRET). This ShadowAuxin biosensor will be dark when auxin is absent and will glow in plant cells when the hormone is present. In order to confirm that this "quenching" process is working as predicted, I fused the glowing protein and the quenching protein together and put them into yeast. This allowed for analysis of how the proteins operate in a living

organism. Preliminary analysis revealed effective light quenching between the ShadowAuxin biosensor proteins. This discovery represents a promising step toward the completion of the ShadowAuxin biosensor.
Faculty Sponsor: Brit Moss

MADELEINE DUNCAN, A Chemoenzymatic Approach to Total Synthesis of Epoxyquinol A

Many current pharmaceuticals are organic compounds inspired from natural sources. Asymmetric synthesis of these compounds has challenged and fueled the field of organic synthesis for decades. Epoxyquinol A, my selected natural product, is an attractive target for total synthesis due to its biological activity as an angiogenesis inhibitor, its structural complexity, and its low yields when extracted from its natural fungal source. I present two synthetic approaches of epoxyquinol A. Both routes rely on the stereoselective dihydroxylation of benzoates using benzoate 1,2-dioxygenase (BZDO) expressed in *Ralstonia eutropha* B9 whole cells. The obtained (1S,2R)-1,2-dihydroxycyclohexa-3,5-diene-1-carboxylic acids provide chiral building blocks from which to pursue asymmetric synthesis of epoxyquinoid natural products. In both cases, I present the challenge of selectively installing the desired epoxide on the hexadiene ring, and the crucial oxidative transposition yielding a formal synthesis of epoxyquinol A.
Faculty Sponsor: Jon Collins

COLE EDWARDS, ELSA HAGER, SARAH MYERS, Psychopathy, Relationships and Online Trolling

Online trolling is a disruptive, antisocial behavior that occurs on the internet. It is crucial to better understand this phenomenon because individuals who are victims of trolling may experience serious emotional distress. Researchers have established a link between online trolling and psychopathy; how the two are related has not been studied extensively. One theory suggests that individuals may turn to excessive use of social media to compensate for poor offline relationships. In our study, participants 18 years and older were surveyed online. Our presentation focuses on this research and the prediction that relationship quality will mediate the association between online trolling and psychopathy.
Faculty Sponsor: Pavel Blagov

RILEY ELLINGSEN, The Role of Interleukin-1 Receptor Accessory Proteins in Normal Homeostatic Responses to Sleep Deprivation

Injection of exogenous interleukin-1β (IL-1β) can induce sleep deprivation (SD)-associated symptoms such as memory and performance impairments, depression, and fatigue, as well as chronic sleep loss-associated pathologies including metabolic syndrome, chronic inflammation, and cardiovascular disease. In some cases, these can be blocked via IL-1β signaling inhibition. IL-1β is a pro-inflammatory cytokine that has been established as a sleep regulatory substance. IL-1β signals through the formation of a complex with its IL-1 receptor type I (IL-1RI) and an accessory protein (AcP). There exists an AcP splice variant, AcPb, that is neuron-specific and up-regulated by sleep deprivation. I present an investigation of the sleep responses to SD in AcPb knockout mice. My results demonstrate that AcP and AcPb are required for homeostatic sleep rebound. Understanding cytokine sleep pathways, specifically IL-1β, could facilitate medical advancements that combat SD-associated pathologies and symptoms.
Faculty Sponsor: Elizabeth Danka

YU FENNE, TYLER LEWIS, Mitochondrial Fission During Exercise in Mouse Cardiac Myocytes

An abundance of mitochondria in cardiac muscle cells allows the heart to produce the energy it needs to beat continuously. Dynamic mitochondrial interactions such as fusion and fission facilitate mitochondrial relocation and repair. Cycles of fission and fusion occur in response to pathological stress, such as disease, or physiologic stress, such as exercise. These interactions can remove or restore damaged portions of mitochondria or mitochondrial DNA to mitigate stress. For example, physiologic mitochondrial fission increases a cell's energy production capacity and hence is a necessary cardiac adaptation to exercise. We used a mouse model to investigate whether inhibiting mitochondrial fission would reduce mitochondrial DNA quality and the ability to condition with exercise training. Our study aims to support the role of regular exercise in maintaining cellular quality and a long, healthy lifespan.
Faculty Sponsor: Michael Coronado

LIAN GAMBLE, Preliminary Taxonomic Survey of Heteroptera, Coleoptera: Curculionidae, Coleoptera: Carabidae, and Diptera: Tabanidae in Mondulkiri, Cambodia

Cambodia is part of the Indo-Burma biodiversity hotspot located in Southeast Asia. Despite vast biological variety, the country's brutal recent history has had devastating consequences on natural science studies, including entomology. Insects comprise approximately 80 percent of the world's described species and play vital roles as bioindicators, pollinators and ecological engineers in global ecosystems. In an effort to contribute to baseline knowledge on insects in Cambodia, I conducted a preliminary taxonomic survey in three distinct habitats in Mondulkiri Province. In particular, I analyzed the diversity and abundance of morphospecies in suborder Heteroptera; in Diptera: Tabanidae; and in the families Carabidae and Curculionidae of order Coleoptera. Only three out of 107 morphospecies were found at all three study sites, making clear the importance of preserving diverse habitats. Analysis of a species accumulation curve indicates that a high quantity of Heteroptera and Coleoptera: Curculionidae species would be collected upon further research.
Faculty Sponsor: Delbert Hutchinson

FRANKIE GERRATY, Anthropogenic Impacts on Mangrove Crab Diversity, Relative Abundance and Zonation

While studying abroad at the School for Field Studies in Panama, I became fascinated by the unique symbiotic relationship

between mangrove trees and crabs in intertidal mangrove forests. Crabs are one of the most abundant groups of fauna that inhabit mangrove forests and are known to play a vital role in soil aeration, nutrient enrichment and propagule establishment. Despite large-scale mangrove deforestation globally, little is known about the impacts of anthropogenic coastal development on the relative abundance, species composition and zonation of mangrove crabs. My study intends to fill in this research gap as the first quantitative description of crab communities in human-disturbed and human-undisturbed mangrove forests in Bocas del Toro, Panama.
Faculty Sponsor: Delbert Hutchinson

SYDNEY GILBERT, The Impossibility of Detecting Terrestrial Planetary Engulfment Events

Near the end of its life, the sun will become a red giant. It will be brighter, its surface larger. Models used in my study predict the sun will expand to reach Venus' orbit. As it is engulfed, Venus' orbital decay will generate power due to drag as it falls through the gas in the outer layers. The gas will have a very low density ($\rho \approx 10^{-9}$ g/cm^3), and Venus will fall inward slowly ($v \approx 1.20 \bullet 10^{-7}$ m/s). As a result, the orbital decay power, L_{decay}, will be low (~10^{22} W) for the majority of the infall, peaking at $6.87 \bullet 10^{29}$ W near the sun's core. As $L_\odot \gg L_{decay}$ until it nears the core, this event will be difficult to observe, causing only minor changes in the sun's luminosity. It will be nearly impossible to detect engulfment events in solar-type stars with similar planetary companions.
Faculty Sponsor: Nathaniel Paust

IAN GINGERICH, Differences in Saccade Task Gaze Metrics Following Mild Traumatic Brain Injury

Concussion, or mild traumatic brain injury (mTBI), is the most common head injury sustained by athletes (an estimated 3.8 million sports-related concussions annually in the United States). Despite these epidemic proportions, the diagnosis and treatment of mTBI continues to be an issue due to a lack of objective, quantitative measures of evaluation. Current research indicates that the occurrence of multiple concussions can have lasting impacts on individuals; studies indicate correlations with mental health issues including anxiety, depression and dementia later in life. It is therefore imperative to develop quantitative measures to investigate concussions. My research focuses on examining discrepancies in combined eye and head gaze movement metrics pre- and post-injury (using video-oculography, i.e. eye tracking, and head accelerometers) as a way to detect concussion. My results show differences in overall gaze movements, but here I also describe differences in the head movement of gaze that varies among subjects.
Faculty Sponsor: Thomas Knight

BROOKE HAINES, The Effect of Bedrock Strength and Depth on Landslides, Kaikoura, New Zealand

Landslides can be lethal when they occur unexpectedly and in close proximity to human occupation. Rock strength may affect the likelihood of hillslope failure and should be analyzed for risk management. I quantified rock mass strength and bedrock depth in hillslopes that failed after the 2016 Kaikoura, New Zealand, earthquake, testing the strength of rock samples from three different landslides. Stronger rocks have strengths greater than 250 megapascals (MPa); rocks I observed averaged 3.38 ± 0.75 MPa. In addition, I found that the smallest landslide's intact rock depth was several millimeters, whereas intact rock depth at the largest landslide measured about 2 meters. My findings suggest that the depth to a plane of weakness between a soil layer and intact rock could be a factor controlling landslide size. Rock mass condition and depth to intact rock may have contributed to the numerous landslides that occurred after the 2016 Kaikoura earthquake.
Faculty Sponsor: Nick Bader

KARI HAMPSON, OWEN CRABTREE, "That's Disgusting!" Conceptual Reorientation Modeled Through Eye Tracking Data

Our study seeks to determine whether conceptual reorientation can reduce disgust, testing the theoretical claim that disgust is impervious to cognitive input. We test conceptual reorientation by showing participants disgusting images that appear real. We then inform the participants that the pictured objects are fake. We hypothesize that conceptual reorientation of the disgusting images (specifically, informing participants that the objects they are viewing are replicas of the object) will render the images less disgusting, both in eye-gaze and self-reporting. If results mirror our hypotheses, they imply that, contradictory to previous research (by Rozin et al.), images do not always equal their objects, and disgust is not permanently stubborn.
Faculty Sponsor: Tom Armstrong

JOHN HAPP, Peroxiredoxin III and NADPH-Generating Enzymes: Obligatory Components of the Peroxiredoxin/Thioredoxin Antioxidant System

Insulin-producing beta cells are thought to be damaged by oxidative stress during the pathogenesis of both type 1 and type 2 diabetes mellitus. Reactive oxygen species, namely hydrogen peroxide (H_2O_2), are primary mediators of oxidative stress. Studies show that beta cells utilize the peroxiredoxin/thioredoxin antioxidant system to protect themselves against oxidative stress. My findings confirm that the mitochondrial enzyme PRDX3 protects beta cells from H_2O_2-mediated damage, but to a lesser extent than do cytoplasmic peroxiredoxins. Given the role of low concentrations of H_2O_2 in promoting glucose-stimulated insulin secretion, I speculate that beta cells express the mitochondrial PRDX3 at lower levels than they express cytosolic PRDX1 in order to allow H_2O_2 to diffuse into the cytoplasm, where it may play a signaling role. Furthermore, I found that the enzymes IDH1, ME1, and G6PD, which maintain a cellular store of NADPH, are obligatory components of the peroxiredoxin/thioredoxin antioxidant system within beta cells.
Faculty Sponsor: Mark Zajac

THOMAS HARRIS, Laser Interferometer Gravitational-Wave Observatory (LIGO) Glitch Tracking

The goal of the Laser Interferometer Gravitational-Wave Observatory (LIGO) detectors is to detect faint ripples in spacetime caused by the merger of massive compact objects, like black holes and neutron stars, using a Michelson interferometer with Fabry-Pérot cavities in the 4-kilometer arms. Because the detectors have length change sensitivity on the order of 10^{-20} meters, there are many types of unwanted transient signals that affect the calculated gravitational wave strain signal and interfere with searches for real gravitational waves. These are referred to as glitches; finding the cause of a glitch category is the first step to eliminating it. I searched for the source of 60-200 hertz range glitches known as "scratchy" glitches. I found a correlation between elevated ground motion and detection of scratchy glitches, then estimated false alarm rates for their observed coherence. My research supports on-site efforts to eliminate scratchy glitches.
Faculty Sponsor: Gregory Vaughn-Ogin

MEGAN HENRY, Virulence of *Burkholderia cepacia* ATCC 25146 in Onions

My presentation identifies genes linked to virulence of the bacterium *Burkholderia cepacia* ATCC 25146 in onion rot disease. *B. cepacia* is part of a larger complex of several species with similar genomes, but different phenotypes. Some *Burkholderia* species, closely related to *B. cepacia* ATCC 25146, can cause opportunistic infections in cystic fibrosis patients. I tested three different methods for onion inoculation, and established a new model that would allow us to study the pathogenesis of *B. cepacia* infection in onions. Optimization of this model allowed me to test four different strains of *Burkholderia* to determine which were pathogenic. I used transposon mutagenesis to create bacterial mutants that were tested in the model. I found a range of mutants that had variable growth and differences in pigmentation. Further characterization of these strains will help us identify and characterize genes that may be responsible for pathogenicity of the *Burkholderia* strain.
Faculty Sponsor: Elizabeth Danka

ABBY HILL, RIGA MOETTUS, Effect of Competition on Bluebunch Wheatgrass in an Age of Climate Change

Pseudoroegneria spicata (bluebunch wheatgrass) is an important bunchgrass native to western North America. Unfortunately, it is beginning to disappear due to the influences of invasive species, overgrazing, and climate change. Understanding how bluebunch interacts with other plants is key to discerning how those relationships impact its growth, especially as those relationships fluctuate with environmental change. Our study assessed bluebunch on two slopes, one north-facing and one south-facing, to investigate the following question: how is bluebunch affected by competition? We hypothesize that competition inhibits the growth of bluebunch and we predict that the size of bluebunch clumps will be greater in areas with lower overall plant densities. Furthermore, we hypothesize that competition will be greater on north-facing slopes, where the soil is able to retain more moisture due to less direct exposure to sunlight, aiding in the establishment of seedlings, which leads to higher plant density and thus greater competition.
Faculty Sponsor: Tim Parker

ANDREA HOOD, ALEKSA KOSTUR, Authoritarianism, Perceptions of Safety, and Attitudes Toward Punishment in Law Enforcement Officers

Recent events and issues related to the use of force by police underscore the crucial need for research on police personality and behavior. Our study examines the relationship between the authoritarian personality trait, perceptions of on-the-job safety, and attitudes toward punishment in police officers. Authoritarianism, the tendency toward and advocacy for strict obedience to authority, is likely higher in police officers than in the general population. Previous research has also demonstrated a link between law enforcement officers and pro-punishment beliefs, and between authoritarianism and pro-punishment attitudes. Our study introduces perceptions of on-the-job safety as a potential mediating variable, as safety has been linked to both punishment ideologies and authoritarianism. We seek to reveal whether attitudes of law enforcement officers toward punishment and authoritarian behavioral manifestations are affected by the inherent danger of their occupation.

Faculty Sponsor: Stephen Michael

ERINA HORIKAWA, Racial-Ethnic Disparities in Late-Stage Breast and Colorectal Cancer Incidence

My research investigated racial-ethnic disparities in late-stage breast cancer (BC) and colorectal cancer (CRC). Both cancers can be detected early by screenings; disparities in late-stage BC and CRC may be explained by inequitable access to screening. I examined cancer registry data from 2000 to 2015 from the Surveillance, Epidemiology and End Results program (SEER) of the National Cancer Institute. Wider disparities appeared for advanced-stage BC between non-Hispanic whites (NHW) and African-Americans (AA), while smaller disparities were indicated for advanced-stage CRC between NHWs and AAs. For both cancers, urban areas registered a similar result; rural areas did not. Overall, incidence of BC and CRC among African-Americans was highest among all racial groups, indicating a crucial need for equitable access to screening and care for African-Americans. Rural areas could benefit as well from further research and intervention.

Faculty Sponsors: Jason Pribilsky and Jim Russo

HAILEY HUNTER, Reconstructing the Evolution of Tooth-Bearing Bones in African Snakes Using 3-D Reconstruction from CT Scans

Natural history collections of preserved animals provide opportunities for researchers to investigate and understand the natural world. One limitation of such collections, however, has been that specimens may be too valuable to be studied in ways that are destructive (e.g., dissection). Studying the internal anatomy of preserved animals using CT scanning offers a non-destructive alternative. Drishti, a software tool for exploring volumetric data sets, provides this opportunity to researchers, turning the images from a CT scan of a specimen into a three-dimensional rendering. I rendered images of specimen skulls using data from Duke University's MorphoSource archive in order to examine the evolutionary morphology of the tooth-bearing bones in snakes of the family Lamprophiidae. Using Drishti, I was able to highlight and isolate structures and show how they compare to others in the family. This software paves the way for the future of zoology and other fields.

Faculty Sponsor: Kate Jackson

AUSTIN KAMIN, Polycyanation of Iodinated Boron Clusters via Palladium-Catalyzed Cross-Coupling

Novel compounds based on extremely stable boron clusters have a wide array of potential applications ranging from new drugs to advanced electronics. Recent computer modeling shows that some of these boron clusters, when appropriately modified, could function as superior electrolytes in lithium and magnesium-ion batteries. In order to make these new electrolytes, we would need to replace the atoms on the boron clusters' vertices with cyano groups (i.e. C≡N, groups comprised of one carbon and one nitrogen). However, it is only recently that chemists could attach even one cyano group to a boron cluster. My preliminary findings suggest that we have been able to synthesize an exciting new boron cluster with *twelve* cyano groups — *closo*-dodecacyanododecaborate — through a special reaction called copper-promoted palladium-catalyzed cross-coupling, using extreme reaction conditions (e.g. 200° C and pressure >25 atm).

Faculty Sponsor: Mark Juhasz

MOLLY KANAGY, Creating a Lloviu Pseudotype Virus Using Modified VSV Plasmids

Filoviruses are a family of viruses including the Ebola and Marburg viruses which pose serious threats to global health, as evidenced by the 2013-2016 West African Ebola outbreak. Lloviu virus (LLOV) is a recently discovered filovirus associated with large bat die-offs in Spain and Hungary. Its effects on humans are unknown; however, similarities to other deadly filoviruses suggest it may have similar infectivity. Live LLOV has not been isolated, hindering vaccine research and development. The goal of my project is to develop a model "pseudotype virus" of LLOV using non-pathogenic vesicular stomatitis virus (VSV) as a backbone expressing LLOV viral envelope glycoprotein. I modified and optimized existing methods used to produce VSV pseudotype viruses by transfecting cells with plasmids expressing the VSV genome, modified to produce LLOV viral envelope glycoprotein. This pseudotyped LLOV can now be used to test vaccines against LLOV and provide insights into this understudied virus.
Faculty Sponsor: Dan Vernon

CAROLINE KARSCHNEY, LEAH SHAFFNER, Rehumanization as an Intervention for Disgust-Based Prejudice: The Case of Ableism

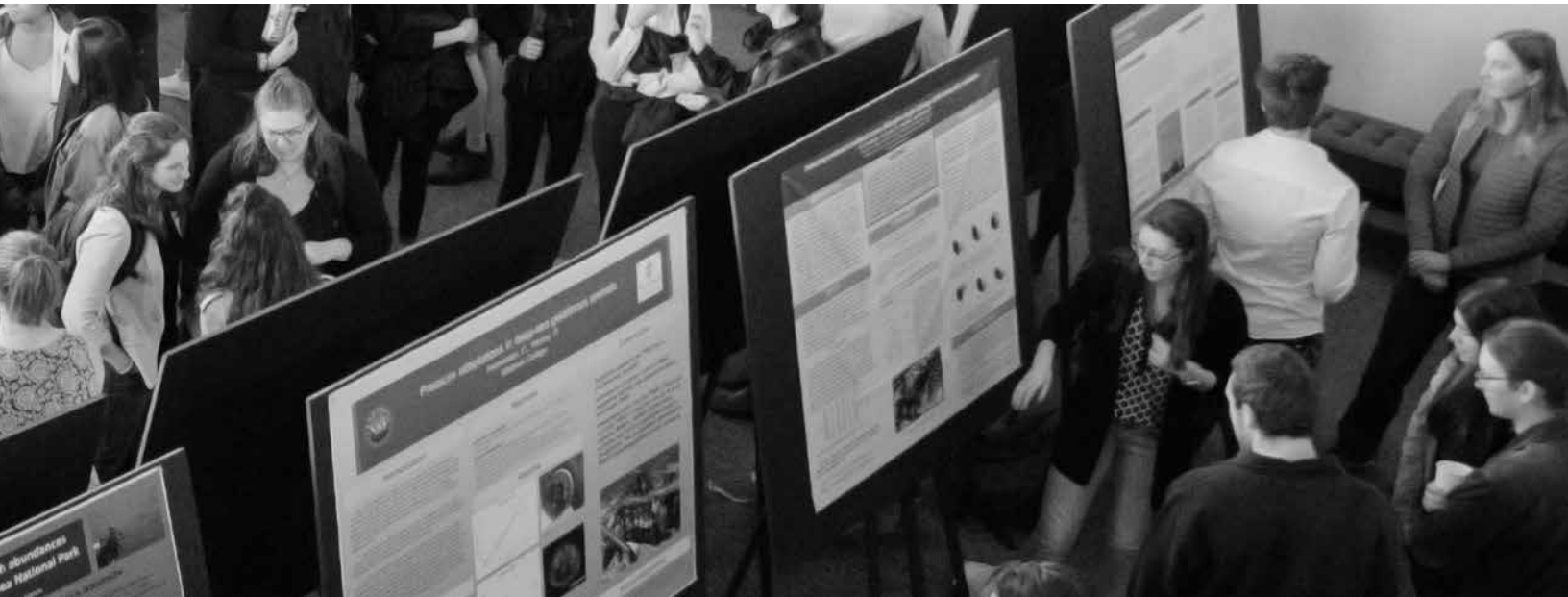
People with disabilities (PWD) comprise one of the largest minority groups and are the target of widespread prejudice and discrimination. Despite making great progress in understanding racial and gender bias, social psychologists have given scant attention to biases related to ability. A handful of studies have sought to understand ableism as a form of disgust-based prejudice. Disgust is an emotion that evolved to prevent disease transmission by motivating avoidance of contaminated objects or people. Evolutionary psychologists have claimed that nonconforming bodies or behaviors associated with PWD may be mistaken for disease cues, leading to disgust-based prejudice. Social psychologists also suggest that privileged groups (i.e., able-bodied people) may project disgust onto marginalized groups (e.g., PWD) to dehumanize them and justify their mistreatment. Our study seeks to determine if rehumanizing interventions are effective at reducing disgust-based prejudice toward PWD.
Faculty Sponsor: Tom Armstrong

ALICE KESLER, N-Ethyl-N-Nitrosourea (ENU) Mutant Cells Show Resistance to Anti-Cancer Drugs

Cancer remains one of the most difficult medical conditions to treat due in part to the development of resistance to anti-cancer drugs. Mutations that lead to resistance can be identified through studying mutant clones. To investigate how drug resistance develops in cancer cells, I grew two lung cancer cell lines, consisting of wild-type and mutated clones, to develop cells resistant to tyrosine-kinase inhibitors (TKIs), an important class of anti-cancer drugs. I compared cell proliferation and viability rates of the two lines to show that there were intrinsic differences between the wild-type and mutant clones' resistance. My results indicate that mutant clones developed greater resistance to toxic drug concentrations (5,000 nanomolar) than did wild-type clones. Future steps include sequencing the genomes of these cell lines in order to identify the exact differences in their resistance mechanisms. These data will yield valuable information about potential drug targets that could enhance targeted therapies.
Faculty Sponsor: Dan Vernon

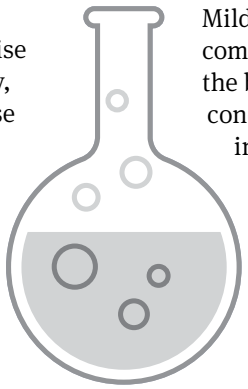
TEAGAN KING, Modeling Earth's Atmospheric Absorption in Support of Palomar/NESSI

During transit in front of a host star, light from the host star passes through an exoplanet's atmosphere and is filtered through Earth's atmosphere before reaching ground-based observatories. Working with NASA's Jet Propulsion Laboratory (JPL), I sought to retrieve spectral features due to exoplanet atmospheres in order to reduce the influence of time-varying telluric features. I wrote radiative transfer code and retrieved mixing ratios of molecules in a synthetic atmosphere using a Markov Chain Monte Carlo model. My project focuses on NESSI, a near-infrared spectrograph at Palomar Observatory's 200-inch Hale telescope, and is being implemented in the JPL team's pipeline to measure absorption features constraining the content of exoplanet atmospheres and provide insight on whether or not they have resources to host life. The project supports all ground-based exoplanet transit spectroscopy data sets, in view of complementing science generated by existing and future observations from space.
Faculty Sponsor: Andrea Dobson



MELISSA KOHL, Image Classification Using Machine Learning at LIGO

The Laser Interferometer Gravitational-Wave Observatory (LIGO) uses interference of light to detect gravitational waves from black hole and neutron star mergers millions of light years away. Gravitational waves are extremely weak compared to vibrations on Earth, making the detector very sensitive to noise that can obscure gravitational waves. Currently, LIGO collaborators transform the transient noise signals in the LIGO detector data, called "glitches," into images called spectrograms, where different wave signals produce different shapes. If the source of the glitch can be determined from the shape, the glitches are eliminated—reducing noise in the detector. The source of one classification of glitch, called a "blip," remains unknown. During the summer of 2018, I generated new spectrograms of blips, discovering six different shapes. I used machine learning to classify these blips, creating a foundation for future collaborators to find the sources of blips and eliminate them.



Faculty Sponsor: Gregory Vaughn-Ogin

ISABEL LA PLAIN, Influence of Heat on mTBI and Associated Gaze Metrics

Mild traumatic brain injury (mTBI, i.e., concussion), is a complicated injury caused by biomechanical forces acting on the brain. It remains unclear why some people struggle with concussion severity and recovery more than others. Because intense physical exercise in warm or hot environments complicates thermoregulation of the brain, I seek to test whether higher ambient temperature at time of injury exacerbates the effects of concussion. I used video-oculography (eye tracking) and accelerometers to measure combined eye and head gaze movements of athletes before and after concussion. I present a discussion of the degrees of difference in these movements following mTBI. My findings will help inform concussion prevention and recovery.

Faculty Sponsor: Thomas Knight

NATHANIEL LARSON, Can Technology Help You Become a Critical Reader?

The educational software Actively Learn aims to strengthen critical reading skills of students in several ways: breaking complex texts into smaller sections; allowing teachers to embed questions and notes into text; facilitating discussion between classmates; and providing feedback to teachers about student reading patterns. Data from the software system may provide a rich picture of the way students read academic documents, what they find important or worthy of comment in the documents, and their level of comprehension of the material. However, these data are contained in a large, opaque, previously unstudied database. In my study, I examined and preprocessed the database, conducted preliminary analysis to uncover trends related to student reading, and identified questions that can be addressed by the data set. This early work lays the foundation for future research about how students read and interact within the Actively Learn system.
Faculty Sponsor: Janet Davis

COOPER LAZAR, Examination of Energy Trends in Graphics Processing Units

My research consisted of creating a series of programs to run on a computer component known as a graphics processing unit (GPU), a specialized electronic circuit designed to accelerate the creation of images for display on an electronic device. With these programs I examined the energy usage of simple computer instructions to better understand how programs can be made to be more efficient. Analyzing and comparing the results from different GPU architectures allowed me to find trends in GPU power consumption, an activity that is currently not well understood. My work can be used by developers to reduce the energy consumption of long-running simulations, some of which run for weeks or months and consume massive amounts of energy.
Faculty Sponsor: John Stratton

BECCA LINN, ALISSA ANTILLA, SARA FEDERMAN, The Shape of Media's Influence: Effect of Body Functionality-Based Intervention on Body Image Satisfaction

Research indicates that nearly 50 percent of young women experience body dissatisfaction, and that women are more likely than men to experience dissatisfaction with body image. Media is identified as a major contributor to body image dissatisfaction. In our study, we examined the influence of body functionality-based intervention on body image satisfaction after being exposed to media that presented thin female characters. We also sought to determine whether an individual's endorsement of traditional gender characteristics moderated the success of any intervention. The results of our research indicate that intervention was particularly beneficial for women who endorsed characteristics that are traditionally feminine. These results may help develop future interventions to lessen an individual's body dissatisfaction.
Faculty Sponsor: Erin Pahlke

EMMA LUNGREN, Comparative Morphology of the Digestive Tract in Solitary Bees

All bees depend on flowers for sustenance: adult bees consume pollen, and female bees collect and feed pollen to larvae. Of the 20,000 bee species worldwide, each one relies on a specific, differing assortment of plants for pollen. Given their contrasts in diet, do bee species also differ in the dimensions of their alimentary canals, where pollen is processed and digested? My research compares the length and volume of several gut regions across six solitary bee species found in Walla Walla. For each species, I dissected five specimens of each sex, and photographed and measured their digestive tracts with a high resolution caliper. The data reveal significant differences in gut regions between species, as well as between males and females within species. My findings set the stage for studies on other types of bees, including pollen-specialist bee species, in order to better understand how phylogeny and diet modulate gut morphometrics.
Faculty Sponsor: Heidi Dobson

MELIA MATTHEWS, Quantifying and Genetically Mapping Complex Traits in *Mimulus* Hybrids

Mimulus is a biologically diverse genus of flowering plants used for studying the evolution of novel phenotypes. Striking, spatially complex patterns of petal coloration have been discovered in hybrids of *M. luteus* var. *variegatus* and *M. cupreus*. The genetic basis for this type of hybrid-specific patterning is unknown. Along with our partner lab, my colleagues and I at Whitman have grown, photographed and sequenced more than 350 F2 hybrids. I used MATLAB and Python image analysis software to quantify the speckling patterning seen in these hybrids. I quantified and genetically mapped traits such as carotenoid intensity, proportion anthocyanin, centeredness, tip spots and more. I have found significant quantitative trait loci (QTLs) on the *Mimulus* genome that correlate with aspects of the complex phenotype.
Faculty Sponsor: Arielle Cooley

LIZ MEADOR, Predicting Galaxy Distribution with LSST ProtoDC2 and Observing Matter-Galaxy Relation with FLASK

It would be an understatement to describe our universe as anything but huge. For many cosmologists, the goal of their research has been to gain a better understanding of the ways in which our universe maintains its immense structure. The correlation function, which details the distribution of galaxies, has long been used by cosmologists to probe large-scale structure. My research focuses on using the correlation function in three fundamental ways. First, I deal with functions produced from input data taken from the Large Synoptic Survey Telescope (LSST). Secondly, I compare the correlation functions from LSST to those predicted in the program CosmoSIS (which allows for different cosmological parameters). Finally, I focus on correlation functions from the Full-sky Lognormal Astro-fields Simulation Kit (FLASK), a program that generates simulated catalogs with different galaxy bias values, which describe the relationship between the distribution of galaxies and matter.
Faculty Sponsor: Andrea Dobson

ELSA NADER, Diffusive Gradients in Thin Films Research

Diffusive gradients in thin films, or DGT, is an environmental chemistry technique in which a binding agent within resin beads is used to test metal bioavailability in natural waters. My research in Assistant Professor Nate Boland's aquatic chemistry lab questions the established kinetic assumptions made in DGT calculations, which assume a disjunctive mechanism, meaning that all the metal captured by the chelating agent in the resin is free metal. I hypothesize that this assumption is incorrect, and that semijunctive or adjunctive mechanisms are also possible. To test my hypothesis, I measured the nickel (Ni) uptake rate of a chelating resin in the presence of various ligands. My results revealed differing uptake rates with different ligands. My finding is significant because it could disprove a commonly-made kinetic assumption of DGT and as such have implications for the interpretation of DGT data. Future research will involve testing the effect of different resin types.
Faculty Sponsor: Nate Boland

ELLE PALMER, Exploring Patterns of Pollen Foraging and Ovary Maturation in Two Semisocial Native Bees

Of the 600 bee species native to Washington State, some are eusocial, most are solitary, and some are semisocial, with a division of labor in the group, between egg-laying and non-egg-laying females. My research focuses on two semisocial sweat bees, *Halictus rubicundus* and *H. ligatus*. I sought to explore whether and in what manner pollen feeding in these species is correlated with ovary maturation. I collected bees returning to nests weekly throughout the summer of 2018, and dissected 43 females to measure oocyte size and score the amount of pollen in their gut. Data analysis shows a broad range of oocyte size, confirming that only some females in each nest are egg layers. I also found the amount of pollen consumed by bees to vary widely. Further analysis of my data will contribute to our understanding of ovary development in relation to pollen feeding and collecting behaviors.
Faculty Sponsor: Heidi Dobson

RACHEL PRICE, GAUTAM PRODUTURI, Searching for New Multiple Myeloma Treatments with Fewer Side Effects

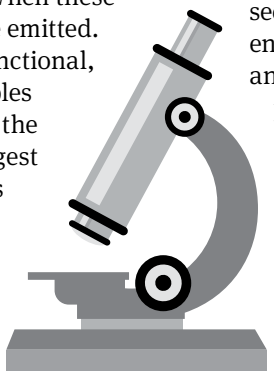
The human 20S proteasome is an enzyme that degrades intracellular proteins, including tumor suppressors, and is a common chemotherapeutic target in cancers such as multiple myeloma. Current clinical treatments of multiple myeloma can cause an array of severe off-target effects, even cardiac arrest. We aim to synthesize compounds that inhibit the proteasome potently and selectively to mediate the proliferation of malignant cells in multiple myeloma. These molecules mimic the fungal metabolite TMC-95A, a large macrocyclic natural product, and Carfilzomib, a synthetic drug currently used to treat multiple myeloma by inhibiting proteasome activity. Preliminary analyses of these novel inhibitors of the human 20S proteasome showed moderate inhibition of enzyme activity. We found inhibition to be selective for the proteasome, with no inhibition of other representative enzymes, lowering the risk of off-target effects. We confirmed the essential bonding interactions of the inhibitor in the active site of the proteasome using X-ray crystallography.
Faculty Sponsor: Marion Götz

ETHAN RAFFMAN, Palladium-Catalyzed Alkene Addition to Carboranes

Carboranes are a type of small molecule with a core shell built from boron and carbon atoms. They have potential uses in both medicine and many exotic types of chemistry; one type of carborane was used to create the longest-ever bond between two carbon atoms, and a different cluster finds a use in making the strongest superacids. My carborane of choice, the CB_{11} cluster, is very stable, which makes it very unreactive and difficult to manipulate. In order to use it in medicine, it is necessary to attach groups that mimic biological systems, but few reactions to do so are known. I am working to use Nobel Prize-winning palladium-based cross-coupling reactions to introduce organic groups to the cluster. I have succeeded in using one such reaction, the Heck reaction, to make a new, never-before-made molecule: the styrenated $CB_{11}H_{11}$-12-C_8H_8.
Faculty Sponsor: Mark Juhasz

MICAH RAMBO, ShadowAuxin: A Biosensor Using a Pair of Fluorescent Proteins

Auxin is a plant hormone responsible for growth and development. Biosensors that track auxin in plant tissue are typically slow to respond or rely on loss of signal. I am pursuing a novel way to measure real-time auxin activity by gain of signal, using two proteins: one glows green while the other absorbs green light and remains dark. When these proteins are next to each other no light will be emitted. To ensure the ShadowAuxin biosensor was functional, I attached it to an additional protein that enables control of the interaction, and then expressed the proteins in yeast cells. My initial findings suggest that the interaction between these proteins is not working as expected and may in fact be toxic to the yeast, preventing confirmation the biosensor's functionality. I plan next to express the proteins at lower levels to test whether this allows for functionality to be regained.
Faculty Sponsor: Brit Moss



ATHEN REID, STACEY AMEZQUITA, MARIAH NG, Children of Incarcerated Parents: Effects of Stigma in an Academic Setting

The classroom should be a safe, equitable learning environment for every child. Stigma-based prejudice by teachers toward at-risk youth may negatively affect their development and performance in the classroom. More than 25 percent of prison inmates in America are the parent of at least one child, underscoring the importance of examining stigmatization of students who are children of incarcerated parents. To evaluate an intersectional theory of social stigma, we used an online experiment to test the interaction between parental incarceration and race in predicting stigma-based prejudice toward students by middle-school teachers across the nation. We share the results of our study in our poster presentation.
Faculty Sponsor: Pavel Blagov

JONAH RODEWALD, Repeated Evolution in Chilean *Mimulus*: Expression of *Myb2b* and *Myb3a* in *Mimulus naiandinus* Petal Lobes

My research focuses on the expression of Myb genes in the petal lobes of *Mimulus naiandinus*, a species of Chilean monkeyflower. Myb genes code for transcription factors in the anthocyanin synthesis pathway. Anthocyanin is a naturally occurring pigment found in many blue, purple and orange-colored plants. Interestingly, petal lobe anthocyanin pigmentation has evolved independently in several *Mimulus* species, including *M. naiandinus*. Using a variety of molecular techniques and genetic tools, I determined the presence of *Myb3a* expression and the absence of *Myb2b* expression in *M. naiandinus* petal lobes. I am now working to determine whether *Myb3a* is necessary to the production of anthocyanin in petal lobes, using an RNAi knockdown followed by analysis of the transgenic plants for phenotypic change. My findings will help determine what molecular events were involved in the gain of petal lobe anthocyanin.
Faculty Sponsor: Arielle Cooley

SARAH ROTHSCHILD, Paradigms of Urban Development: Addressing Processes of Segregation, Marginalization, and Displacement in Cuenca, Ecuador

Cuenca, the third largest city in Ecuador, has experienced rapid urban development in the past few years. This growth has greatly impacted living conditions in the city for certain sectors of the population. Rapid urbanization has fostered an environment that favors wealthy inhabitants while relegating and segregating communities with fewer resources. This paradigm shift in development has created polarization between sectors of the urban population, leading to social segregation that continues to grow. Cuenca serves as a case study in considering the implications of rapid growth that many Latin American cities have experienced in the recent decades. My presentation examines five relevant themes within this urban context: displacement of communities, foreign presence, segregation, social mobility, and the potential for more equitable urban models.
Faculty Sponsor: Janis Be

CHRIS RUMBAUGH, Rare-Earth Spectroscopy

Seventeen members of the periodic table comprise the rare-earth elements, including scandium, yttrium and 15 lanthanides. These elements are useful in many applications, playing a particularly key role in electronics. I performed spectroscopic experiments on rare-earth crystals and powders with the goal of witnessing the energy transfer between atoms in the materials' lattice structures. To sense the transfer between atoms, I used specific wavelengths of light to excite the samples, and measured the emitted wavelengths. In doing so, I was able to determine which atoms absorbed the light and which atoms emitted it. Referencing known absorption and emission spectra of various atoms, I deduced that energy transfer between atoms was occurring. My collected data are useful in determining rates of intermolecular energy transfer, and have applications in energy efficiency.
Faculty Sponsor: Kurt Hoffman

RHEA SABLANI, Mapping and Characterizing *large scutellar node1 (lsn1)* in Maize

Maize (corn) is an important industrial crop that can be grown in various environments. The corn mutant *large scutellar node1 (lsn1)* exhibits atypical seedling development and severe vascular defects. Seedlings with the *lsn1* mutation have a short primary root with a flattened tip and a bulging scutellar node between the root and shoot. In order to further characterize the *lsn1* mutant, I used traditional genetic approaches and genome sequencing to identify the causative gene. Genetic crosses using *lsn1* mutant plants revealed that the mutation is likely recessive, as two copies of the *lsn1* mutant allele were needed to observe defects. To investigate the connection of *lsn1* with the plant growth hormone auxin, I also crossed *lsn1* plants with auxin mutant plants. Computational analyses enabled me to map and characterize the *lsn1* causative gene to develop a better understanding of its role in regulation of organ development.
Faculty Sponsor: Brit Moss

SUZANNE SCHMITZ, Investigating Light Affinity in *Drosophila americana* and *Drosophila novamexicana*

In order to explore how habitat can influence the behavior of a species, I studied two closely related species of *Drosophila* that differ mainly in their pigmentation and habitat. The lighter colored *Drosophila novamexicana* is naturally found in hotter, drier environments with more sunlight available. Conversely, its darker-colored relative, *Drosophila americana*, is associated with colder environments with less sunlight. I studied how the two species differed in their affinity for light versus dark environments. I placed flies in a sealed chamber and recorded their daily movements between light and dark areas of the chamber. Despite the differing natural light of the two species' native habitats, I found that *D. novamexicana* and *D. americana* did not vary significantly in their preference for light or dark conditions. Future research on additional environmental variables, such as temperature, could provide interesting insights into these flies' behavior and processes of speciation.
Faculty Sponsor: Arielle Cooley

OTTO SCHWARM, Compiling LIGO Coherence Data

The National Science Foundation's Laser Interferometer Gravitational-Wave Observatory (LIGO) is capable of detecting minute ripples in the fabric of spacetime, which are caused by energetic astronomical events such as black holes and neutron stars colliding millions of light-years away. Since the effect of these ripples is small by the time they reach Earth, LIGO uses tools like Gabriele Vajente's Brute Force Coherence (BruCo) to calculate the mathematical coherence between a target data channel and over 4,000 other data channels, in order to distinguish experimental noise from gravitational wave signals. BruCo generates complex output, with only a small amount of useful data among tens of thousands of plots. My research presents an algorithm that selects the top five most interesting channels and compiles their coherence data into a single plot, vastly simplifying BruCo's ease-of-use.
Faculty Sponsor: Gregory Vaughn-Ogin

KATIE SISSON, Epifaunal Surface Cover on Pilings in Bocas del Toro: How Do Age and Urban Proximity Affect Community Compositions Throughout the Archipelago?

As human population increases, mankind shifts to occupy coastal land, creating a demand for artificial structures to fortify coastlines. The Bocas del Toro archipelago in Panama is a prime example of a coastal populace undergoing rapid expansion due to tourism influx. My study examines community composition of organisms on PVC pilings of various ages and proximities to the urban core in order to determine correlation between urban proximity and epifaunal community composition. I analyzed visual quadrats and took circumference measurements of pilings to determine community biomass, calculating Bray-Curtis dissimilarity indices across sites. I found significant values for both urban-rural and old-new comparisons, and discovered that key taxa significantly contribute to this dissimilarity. In contrast, I found biomass variations to be insignificant, indicating that old-new and urban-rural gradients do not affect overall epifaunal growth mass.
Faculty Sponsor: Delbert Hutchinson

SEGUN SODIPO, Are the Pollen Types Consumed by Flower-Generalist Bees the Same as Those They Collect?

Adult female bees need pollen: they carry it on their scopal hairs to the nest to feed larvae, and they also consume it themselves. Among the 4,000 bee species in the United States, many are flower generalists, wherein females collect pollen from many different unrelated plants. I set out to determine whether flower-generalist bee species collect the same pollen that they consume. During the summer of 2018, I collected females of three native bee species at various sites in Walla Walla County. Each pollen-carrying female was dissected to remove the gut. Pollen from both the gut and scopal hairs was mounted on microscope slides, and the pollen species compositions were compared. In general, I found that bees consumed pollen from more plant species than they collected for their nests. This leads to a question for future investigation: why are bees more selective of the pollen they collect for their young?
Faculty Sponsor: Heidi Dobson

EMILY SPRADLING, Pups and Positivity: Evaluating the Impact of Animals on Well-Being

Companionship between humans and animals has occurred for 15,000 years. Is there a reason for it beyond the utilitarian? The growing popularity of emotional-support animals suggests that there is. My study evaluated the impact of exposure to animals on well-being. I examined pre- and post-test levels of well-being and happiness of 42 participants who were asked to look at dog photos, watch dog videos, or interact with a friendly dog for 10 minutes. The results of my study indicate that participants are

happier after any of these experiences. My findings suggest that, contrary to previous research, positive benefits can be gleaned from simply viewing photos and videos of animals. Implications of my study include potential therapeutic approaches to increase well-being, specifically among hospitalized, incarcerated, and elderly populations.
Faculty Sponsor: Erin Pahlke

SAM TABBUTT, Speckle Pattern Interferometry on a Semi-Hollow Electric Guitar

Over the summer of 2018 I worked with Professor Kurt Hoffman to construct an electronic speckle pattern interferometer for the purpose of measuring nodal patterns on vibrating surfaces. I have been using this interferometer to mathematically analyze the acoustic properties of the back face of a semi-hollow electric guitar. My presentation describes the procedure of constructing the interferometer and explores the data I have generated using it. Assembly of the interferometer involved interfacing a digital camera and computer with a reference laser in order to measure nodal patterns. I hypothesize that the mathematical representation of the surface will be in the form of a Bessel function, from which I will be able to determine the various resonance frequencies of the surface.
Faculty Sponsor: Kurt Hoffman

GABY THOMAS, Gene Expression in the Somatosensory Cortex of Sleep-Deprived Mice

Sleep is necessary for almost all animals, yet sleep regulation is not fully understood. By looking at the effects of sleep deprivation in mice, we can identify genes that are key to sleep regulation as it relates to normal and disease states in humans. I used qRT-PCR on somatosensory cortex samples of sleep-deprived mice to measure the effects of knocking out genes for the IL-1 receptor accessory proteins, AcP and AcPb, thus characterizing key pathways important to sleep regulation. I found that immune system-related genes were up-regulated in AcPb knockout samples, while stress-related genes showed contradictory expression in AcP knockout samples. Circadian rhythm-linked genes showed increased expression in AcP knockout samples, while AcPb knockout samples were down-regulated. My findings show that sleep deprivation alters the expression of multiple genes, suggesting that it plays a role in the regulation of many key signaling pathways in the brain.
Faculty Sponsor: Elizabeth Danka

GRANT TRAYNOR, Differences in Pollen Feeding and Collection by Sunflower Bees

Of the 20,000 bee species known worldwide, 4,000 are native to the United States and most are solitary in their lifestyle. Females of many solitary species are specialized with regard to the plants they visit to collect pollen for their larvae. To determine whether sunflower-specialist bees also restrict the pollen they consume for their own sustenance, I collected 71 specimens of three bee species, sampled pollen carried by the females, and dissected all specimens to examine their gut contents. I found that the composition of pollen carried to the nest by females was largely that of sunflowers, as was gut pollen in both male and female bees, with minor variation. My findings show that these bees restrict pollen feeding to the sunflower family, and furthermore specialize on the sunflower itself in pollen collecting; this is perhaps due to the morphology both of the pollen grains and the female's pollen-carrying hairs.
Faculty Sponsor: Heidi Dobson

LAUREN WILSON, Participation of the *PIRL9* Gene in *Arabidopsis* Root Development

Root formation is a complex developmental process including cell elongation, differentiation, lateral root initiation, and response to environmental factors: all processes dependent on gene products. Previous studies suggest the *PIRL9* gene could be involved in lateral root formation. If so, we would expect to see its expression in root tissue, and abnormal phenotypes in mutants lacking *PIRL9*. I created a reporter gene construct by attaching the reporter GUS to the *PIRL9* promoter. I also compared lateral root number, frequency, and length in *PIRL9* knockout mutant plants, as well as in plants defective in a closely related gene, *PIRL3*. My findings confirm that *PIRL9* is expressed in primary root tissue. I did not observe any significant phenotypic differences between the roots of knockout strains and wild type plants. My research confirms *PIRL9* expression in roots, but further experiments are needed to define the exact role of *PIRL9* in root development.
Faculty Sponsor: Dan Vernon

SESSION 1
9-10:15 a.m.

MEDIA AND MODERN TIMES
OLIN 138
Celia Langford, moderator
Erick Franklund, coach

9 a.m. NINA SHARP, Trends in Women's Labor Force Participation in the United States, 1979-2016

While the 1980s and 1990s saw increased participation, to varying degrees, of women in the American workforce, women's participation in the labor force has declined since the turn of the century. There is no agreed-upon explanation for this trend, and questions invariably arise. How have various economic factors such as the median weekly wage, national unemployment rate, and proportion of Americans living in urban areas impacted the labor force participation rate of women in the United States over time? In examining these trends, I estimated a linear regression model, with U.S. women's labor force participation as my dependent variable and various national economic statistics as my independent variables, from 1979 to 2016. My presentation distills an empirical research project that I completed as part of "Introduction to Econometrics."
Faculty Sponsor: Pete Parcells

9:15 a.m. JACKIE GREISEN, Mediation of Media: Parental Discourse with Their Children Surrounding Political Issues

As media pervades modern culture and everyday lives, children have more access to sources of information that is less and less mediated by parents and guardians. At home, with friends, or at school, kids access information beyond parental mediation. This trend led me to research children's access to potent political topics as well as parental discourse about these issues. Specifically through the lens of the #MeToo movement, I examine how parents navigate and mediate their children's consumption of media, how they reconsider their own childhood consumption, and how popular media sources for children portray rape culture.
Faculty Sponsor: Michelle Janning

9:30 a.m. GABBIE WEBBEKING, Sigils, Spells and SpongeBob Memes: An Examination of the Tumblr Witch in the Late Modern Era

The witches on the social media website, Tumblr, are connected by their unbridled passion for sigils, spells and self-deprecating humor. Unfazed by a lengthy history of persecution, these witches thrive in their connections with nature, acts of inner strength and self-care. At the same time, the identity formation of the Tumblr Witch is fraught with contradictions of authenticity, urbanization and capitalism. My presentation explores the ways in which the Tumblr Witch renegotiates and reclaims her identity on social media platforms, such as Tumblr and Etsy, by conducting a virtual ethnography. In doing so, I hope to fill a gap in the sociological research on online witch communities.
Faculty Sponsor: Matthew Gougherty

9:45 a.m. CELIA LANGFORD, Yaoi and the Bishōnen: Depictions of "Beautiful Boys" in Gay Japanese Manga

Yaoi, a genre of Japanese comic books (or "manga"), is dedicated to the depiction of homosexual love between male characters. My research focuses on a specific character type that appears within Yaoi manga, namely the bishōnen, or "beautiful boy." The term bishōnen applies to a character who is sexed and nominally gendered as male, while all the while sending visual and behavioral signals to the reader that complicate his gender image. A bishōnen bears physical characteristics, behaviors and mannerisms that invite a sense of femininity, while at the same time bearing other features and behaviors that invite a sense of masculinity. My presentation visually analyzes the ways in which bishōnen are presented in contemporary Yaoi works, asking whether or how bishōnen might shift the reader's notions of what is and is not gender-intelligible.
Faculty Sponsor: Yuki Shigeto

COMPUTER SCIENCE I
OLIN 129
Melissa Kohl, moderator
Matthew Schetina, coach

9 a.m. PAUL MILLOY, JULES CHOQUART, PABLO FERNANDEZ, BEN LIMPICH, RAJESH NARAYAN, On Glitchy Rice and Buggy Frozen Potatoes: Redevelopment of Blue Mountain Action Council Food Bank's Inventory Management Software

Blue Mountain Action Council Food Bank supplies donations of food from the USDA and other contributors to food pantries in the Walla Walla area, supporting food security and the reduction of food waste. Our team was tasked with updating BMAC's database and inventory management system from a PHP and MySQL web application to an application built from the modern frameworks of Firebase and React. To do so, our team has

faced down dirty JSON files, an overhaul of the previous system's user interface, and a plethora of usability issues. Our presentation covers the team's design challenges and decisions, and we share our experience working with BMAC and its director, Jeff Mathias, as a client.
Faculty Sponsor: Janet Davis

9:30 a.m. MELISSA KOHL, KIRK LANGE, JACK STEWART, Automated Registration for Great Explorations

Great Explorations is a biennial workshop event hosted at Whitman College for local middle-school girls interested in STEM fields. In previous years, registration was carried out by means of paper and the mail. Included in this effort is the task of matching hundreds of girls with their preferred workshops. Our Computer Science capstone project had two main goals tied to Great Explorations: build an informative website with a registration form, and create an algorithm to automate the matching process for the workshops. In our presentation, we discuss the tools we used to accomplish these goals along with the process of working with a nonprofit organization.
Faculty Sponsor: Janet Davis

DARK MATTER AND DNA

SCIENCE 159
Alexander Shaw, moderator
Sarah Rothschild, coach

9 a.m. BENJAMIN COSGROVE, Match Seq: Creating a Web-Based Computer Program for Aligning and Visualizing Genomic Data

With the advent of next-generation sequencing, the field of genetics has a seen a substantial increase in genome-level data sets, making it necessary to build programs that can process them and create quick visual aids for data interpretation. Match Seq is a program built for KBCommons, an informatics framework that hosts tools for the interpretation of a variety of genetic data. Match Seq is entirely web-based and uses several coding languages. This program combines two user-provided data sets that together deliver an understanding of the locations of gene expression and protein production. The program uses a JavaScript library called highcharts to generate two distinct graphs, allowing for quick comprehension of the different levels of gene expression. My research intends to add the ability to pass additional data sets together through the program, to enable the program to predict user inputs and autofill columns, and to optimize the table alignment feature.
Faculty Sponsor: Brit Moss

9:15 a.m. LINDSAY SABER, Single-DNA Molecule Study of Barrier-to-Autointegration Factor (BAF) Protein by Magnetic Tweezers

Barrier-to-autointegration factor (BAF) is a small and highly conserved dimer protein found in eukaryotes. It has various binding targets such as double stranded DNA, lamins, histones and transcription factors. BAF also plays a critical role in nuclear assembly, chromatin organization and gene expression. In prior magnetic tweezer studies, BAF has demonstrated DNA condensation by loop formation in a BAF-DNA complex. My research investigates the strength of these BAF-DNA bonds at a range of applied forces using magnetic tweezers. I performed additional experiments with VRK1, a known phosphorylating agent, as well as mutant BAF dimer. My results suggest that BAF binds quickly and strongly to loosely extended DNA. Phosphorylation of the BAF-DNA complex causes binding to weaken, while use of a mutant dimer shows no significant DNA compaction.
Faculty Sponsor: Mark Zajac

9:30 a.m HENRIQUE ENNES, From Cosmos to Quantum: A Study of Dark Matter Nuclei

Many experiments have confirmed the existence of a type of matter that accounts for about 22 percent of the energy density in the universe but does not interact with light. Scientists call it dark matter (DM). Although the exact nature of DM particles is still unclear, some evidence indicates that a mutual force might exist between them, which would allow for the formation of "nuclei" — similar

to how strong forces between protons and neutrons cause formation of atomic nuclei. The size of these DM nuclei is strongly influenced by the exact nature of the force between the DM particles, which is still experimentally unclear. In my presentation I describe a general model for the forces between the DM particles and implications for 2-particle nuclei. I also sketch how the quantum mechanics nature of 2-particle nuclei affects the final size of DM nuclei in our universe.
Faculty Sponsor: Moira Gresham

9:45 a.m. ALEXANDER SHAW, Bound States of Dark Matter

Dark matter is an unknown type of matter hypothesized as a resolution for disparities between astrophysical theory and observation. The bullet cluster gives us a picture of two galaxies post-collision and demonstrates the necessity of dark matter. This picture also indicates that dark matter must be non-luminous and weakly interacting, both with other particles (protons, electrons, etc.) and itself. Although weak, the strength of self-interaction may be enough to bind dark matter particles together in states similar to those of traditional atomic nuclei. In my presentation I discuss the motivation for self-interacting dark matter and I introduce research regarding the relationship of the hypothetical self-interaction strength to the expected distribution of particles bound together, which has direct implications for larger-scale questions about the structure of the universe.
Faculty Sponsor: Moira Gresham

WILD KINGDOM

SCIENCE 100
Anna Ripley, moderator
Natalie Mutter, coach

9 a.m. SANDY HATTAN, Prothoracic Gland in *Caligo* Caterpillars as Defense Against Army Ants *(Eciton burchellii)*

Evolution of defensive mechanisms is paramount for fitness and survival of vulnerable prey organisms. In my presentation, I examine the predator-prey interaction between army ants *(Eciton burchellii)* and caterpillars of the owl butterfly *(Caligo memnon)*. These caterpillars have a prothoracic gland in their third, fourth and fifth instars, which I hypothesize plays a role in defense. I placed caterpillars with and without prothoracic glands covered in clear nail polish into army ant foraging columns. Overall, I found that army ants did not take the larvae as prey items. This could be due to large caterpillar size, heavy integument and defensive behaviors such as vomiting, biting, displaying their horned heads and body thrashing. The gland does not appear to play a protective role against army ants; however, further studies are necessary to determine whether it provides protection from other predators such as bullet ants or parasitoids.
Faculty Sponsor: Susanne Altermann

9:15 a.m. SARAH SMITH, Family Dynamics of Semi-Captive Pygmy Marmosets in the Ecuadorian Amazon

The pygmy marmoset is a vulnerable species of monkey in Ecuador. Due to human activities such as deforestation and illegal pet trafficking, their population is rapidly declining. On an island in the Ecuadorian Amazon, a monkey rehabilitation center named Sumak Allpa shelters a troop of six pygmy marmosets, including a recently-born infant. I observed and followed the development of this infant and its interactions with other members of the troop in order to determine the health of the family. I categorized and quantified behaviors in order to determine time allocation and behavioral trends of the troop. My findings reveal that this troop is developing in a healthy manner and that the infant, specifically, is demonstrating appropriate behaviors for its developmental period. My study of this troop provides evidence that it would be successful in translocation from the rehabilitation center.
Faculty Sponsor: Delbert Hutchinson

9:30 a.m. GARETH JONES, Amphibians and Reptiles in Ecuador: Establishing Baseline Data for Populations in Biological Reserves

Due to human-driven habitat loss, climate change and disease, reptile and amphibian conservation efforts are becoming increasingly important. My study creates a set of baseline data for populations in the Rio Machay Biological Reserve and Lot G Protected Forest of Ecuador. These data will allow for continued monitoring of reptile and amphibian populations and encourage further conservation of the extreme biodiversity in the Pastaza Valley. I employed visual encounter surveys at varying locations and elevations within the reserves to provide a relatively comprehensive population estimate. My findings include ecological information and behavioral observations for each species captured, and I also present an analysis of species diversity, sampling effort and inter-habitat comparisons. Included within the 152 individuals captured are several potentially new species of frog, an endangered frog and an endangered salamander.
Faculty Sponsor: Kate Jackson

9:45 a.m. ANNA RIPLEY, Snake Scale Microstructures: A Comparison of Imaging Approaches

Biologists often study organisms based on their physical features. As microscope technology improves, new structures are revealed to science. Microstructures offer insights into a species' phylogeny and adaptations. I imaged scale microstructures of *Charina bottae* (rubber boa) and *Thamnophis sirtalis* (common garter snake) using a scanning electron microscope. These species diverged 90 million years ago but occupy similar habitats in overlapping ranges, making them ideal for comparison. To determine optimal imaging techniques, I compared images of dried sections of integument, resin casts and shed snake skins. I found that the dried

integument and shed skins yielded superior images. I then compared the microstructures of dorsal and ventral scales from different body sections. I also compared images of *C. bottae* and *T. sirtalis* microstructures with those of other snake species. My results will guide researchers in selecting effective study techniques and contribute to our understanding of microstructure function and evolutionary advantage.
Faculty Sponsor: Kate Jackson

MYTH, CANON AND MEANING

KIMBALL THEATRE
Chloe Daikh, moderator
Anthony Reale, coach

9 a.m. LEO LIN, Absurd Freedom

Absurdity and freedom are concepts that may seem to operate independent of one another, but they can also be seen as two perspectives of the same behavior. In Shakespeare's "The Tempest," two characters, Caliban and Ferdinand, find themselves in the same situation: They are forced into hard labor by Prospero. Strangely, Caliban, who fights against his slavery, is the character who appears to be absurd, while Ferdinand, who meekly accepts his slavery, is the character seen to be exercising free will. In my presentation, I argue that "free" and "absurd" are merely labels we assign to people whose personal desires either contradict or conform to their environment. Although freedom and absurdity are only labels, the correlation between the two may be instrumental in solving our own existential crises. When we truly perceive the absurdity of our daily life, we may also recognize our freedom.
Faculty Sponsor: Jennifer Mouat

9:15 a.m. ETHAN RAFFMAN, The Magna Mater: (Re)defining Roman Divinity

Ancient Roman deities such as Jupiter, Juno and Pluto are widely known. Lesser known are the gods and goddesses imported from across the Roman Empire and incorporated by the Romans into their culture. The goddess Magna Mater (Great Mother) is a peculiar example of this practice. While worship of her was distinctly categorized as "foreign," she was given a place of honor in the Pantheon and seen as an essential part of the history of Rome. Adding further complexity to the matter were the *galli*, the sexually active eunuch priests of Magna Mater who both complicated and defined Roman notions of gender and sexuality. My presentation explores these incongruities and concludes that, by studying Roman attitudes toward this unusual goddess and her priests, we can better understand how Romans defined their gods, ultimately positioning their culture as superior in its claim to expressing fear and awe of divinity.
Faculty Sponsor: Sarah Davies

9:30 a.m. HANNAH FERGUSON, Reciprocity in Bucolic Song: A Study of Theocritus' "Idyll 1"

The Hellenistic poet Theocritus of Kos is widely considered the founder of pastoral poetry. His first idyll, set in the rustic countryside at midday, presents a friendly competition between two poets, one a renowned singer and shepherd, the other a lowly goatherd. Within this idyllic landscape of goats and gurgling streams, "Idyll 1" contains a complex medley of themes, power dynamics, and poetic structures that have posed significant interpretive problems for classicists despite their extensive scholarship on the subject. In my presentation, I share my research on the nature and significance of reciprocity in ancient Greek culture in order to analyze the central role of reciprocity in "Idyll 1." This research contributes a fresh perspective to the larger body of classical scholarship about reciprocal poetry and Theocritus while also addressing some of the persistent interpretive problems in "Idyll 1."
Faculty Sponsor: Dana Burgess

9:45 a.m. CHLOE DAIKH, Confronting Ancient and Modern Sexism Through the Poetry of Sulpicia

What role did women play in the ancient Roman world? How have ancient views of women affected modern perceptions? My presentation addresses these questions and examines the lack of representation of women in what has become the canon of Roman literature. The vehicle for my examination is the poetry of Sulpicia, the only female Roman poet whose work survives. Using my own translation of Sulpicia's "Poem XII," I provide a close reading of the Latin in the context of the Late Republic and Augustan eras. I then address the issue of Sulpicia's place as a female author in the classical canon. Often, modern scholarship has approached Sulpicia in two ways, either claiming that her poetry was written by a man or questioning its quality. Both approaches reveal a modern bias which, while rooted in ancient misogyny, surprisingly contrasts with a certain degree of acceptance for female authorship in ancient Rome.
Faculty Sponsor: Sarah Davies

HISTORY, IDENTITY AND PLACE

REID G02
Connell Boken, moderator
Caroline Bauwens, coach

9 a.m. FLORA KLEIN, Gender and the Ottoman Harem

The Ottoman harem, often associated with heightened sexuality, was replete with complex, gendered spheres of influence. Overarching notions of a private, feminine "haremlik" and a public, masculine "selamlik," maintained through Orientalist discourse, are increasingly challenged when considering the acoustic dimension of these spaces. As a mechanism of control, these "affectations," from müezzin chants to Ottoman sign language, both maintained and delegitimized power relations. My presentation utilizes a phenomenological lens to add a layer to Foucault's concept of panopticism, drawing upon affect theory to argue the acoustic

dimension of "governability" as it pertains to the gendered spaces of the Ottoman sultanate. My presentation explores the burgeoning intersection of affect theory and sound studies in the field of history, and uses close readings of textual sources to illuminate overlooked narratives and rethink past narratives, asking my audience to "listen" to history.
Faculty Sponsor: Elyse Semerdjian

9:15 a.m. REE ROBSON, Concubine's Companions: Gendering African Eunuchs in the Ottoman Empire

Major scholarship devoted to African eunuchs of the Ottoman Empire is only a recent advancement, despite their important role in the maintenance of female seclusion and elite lifestyles. As enslaved domestic servants as well as liminal figures who maintained gender divisions and enjoyed access to powerful leaders, African eunuchs were paradoxical figures with significant political influence. In my presentation, I complicate accepted narratives about African eunuchs by analyzing the gender roles created around them as well as their relationships with harem women. How did the harem shape gender and social/political relations? Can we trust historical depictions of African eunuchs, or are they fantasies? What kind of masculinity did eunuchs embody and symbolize? African eunuchs kept silent about their harem experiences. Yet, by interrogating the assumptions and stereotypes underlying traditional narratives about them, we can begin to reinterpret their lives and history.
Faculty Sponsor: Elyse Semerdjian

9:30 a.m. TYLER PHILLIPS, Dialect and Regional Identity in Modern Germany

Standard German arose out of the need for a common written language that could be understood by the speakers of a wide spectrum of German dialects. Standard German has come to dominate in written form, but traditional dialects and various mixed forms that combine dialect, standard and new innovations still dominate in everyday speech. Many regions in Germany maintain a sense of regional identity and culture distinct from that of Germany as a whole, and the use of traditional dialects often plays a key role in promoting that identity. Bavaria, for example, is known for its strong independent mindset and its dialect, which is relatively distinct from standard German. My presentation explores a region less often talked about: Hesse in central Germany. I investigate the way Hesse uses its dialect, Hessian, to promote a sense of regional identity.
Faculty Sponsor: Emily Jones

9:45 a.m. BASSEL JAMALI, Stephen B.L. Penrose Jr. and Palestinian Refugees

The 1948 Arab-Israeli War resulted in an estimated 700,000 Palestinians fleeing from their homes and settling in what is now the West Bank, the Gaza Strip and neighboring countries. The overwhelming majority of these refugees were never able to return to their place of origin. The case of Palestinian refugees, who became stateless, posed one of the first challenges to the post-World War II order, when a new era of internationalism and universal human rights dawned. Through the exploration of the life of Stephen B.L. Penrose Jr., son of a Whitman president who became an advocate for the plight of Palestinian refugees, my presentation seeks to situate the debate around immigration and nationality in the context of Palestinians after 1948 and to explore various facets of early discussions about the rights of Palestinian refugees.
Faculty Sponsor: Elyse Semerdjian

10 a.m. CONNELL BOKEN, Reinventing Main Street

America's Main Street is as much a constructed concept as it is a physical place, in that towns will often promote themselves through the architecture of their main commercial centers. In the case of Pasadena, California, a city in Los Angeles County, the decline of its main street, Colorado Boulevard, allowed promoters of its historic downtown to reinvent the city, especially its commercial core, the way that they wanted it to be. Thus, Old Town Pasadena was born. My presentation will examine, through images and postcards from different eras in Pasadena's history, how the construction of Old Town drew upon an imagined (and actual) past to invent a new landscape for the city's main commercial district, one that followed and inspired similar trends across the United States.
Faculty Sponsor: Matthew Reynolds

SESSION 2
10:45 a.m.-Noon

RACE, HATE AND TRAUMA
OLIN 138
Olivia Gilbert, moderator
Mayrangela Cervantes, coach

10:45 a.m. RACHEL LOE, The Nazis Were Student Activists?

In the United States, the history of Nazism is commonly understood to be a story of notorious characters: Hitler, Goebbels, Himmler. Lesser known is the role of university students in the expansion and rise of National Socialism. During the Weimar Republic (1919-1933), students became increasingly invested in nationalist thought and actions, igniting a desire to strengthen the community of the people (Volksgemeinschaft) and partake in the awakening of "Young Germany." For the young men whose prospects and pride were diminished in the economic and political chaos post-World War I, National Socialist rhetoric glorifying the Volk was especially enticing. Many students perceived virtue in political standing, a shift from early conceptions of the "apolitical" university. Fraternities and student unions became centers of grassroots activism for the Nazi Party. In my presentation, I argue that student activism contributed significantly to the rise of National Socialism, an influence underrepresented in historical scholarship.
Faculty Sponsor: Lynn Sharp

11 a.m. BRYN LOUISE, EMA DI FRUSCIA, Trade Liberalization, Job Loss and Hate

"*Is* it the economy, stupid?" Are unemployment and trade contributing to the rise of hate groups? Among theories that political scientists and sociologists employ to explain trends in hateful beliefs is "strain theory," which argues that society pressures individuals to achieve accepted goals, though these individuals lack the means to succeed. In context, strain theory connects increased hostility to the perception among majority groups that minorities are stealing economic opportunities from them. Our presentation explores this relationship empirically by studying trends in unemployment, trade openness, hate crime and hate groups. Our findings indicate that sectors most exposed to import competition experience an increase in the number of white supremacy groups as well as hate crimes motivated by racial bias.
Faculty Sponsor: Alberto Ortega

11:15 a.m. MICKEY SHIN, Remembering 9/11 Through News Design: Journalism, Visual Rhetoric and Collective Memory on National Trauma

Though news media outlets claim or aspire to be objective, photojournalism as reflected in newspaper layouts shapes in a subjective way how consumers see, understand and remember major news events. My presentation examines front-page layouts of five major newspapers the day after and 10 years after 9/11 in order to understand how narratives are implicitly built into designs that affirm or reinforce specific, often problematic ways of collectively witnessing and remembering trauma. Drawing primarily on concepts of collective memory and visual rhetoric, my presentation investigates how narratives are represented or misrepresented, influencing how the public literally and figuratively sees their role in understanding 9/11 through the passage of time. More generally, I draw conclusions about objectivity in news media, the role of journalism in memory-making, and where the burden rests in collectively remembering traumatic events.
Faculty Sponsor: Matthew Bost

11:30 a.m. OLIVIA GILBERT, Race, Rhetoric and "The Racial Contract"

Charles Mills' 1997 book, "The Racial Contract," a landmark text in political philosophy, uses language of the social contract to explain the global system of white supremacy. By and large, scholars have approached the theory behind "The Racial Contract" as a way to explain racism in terms more familiar to mainstream — that is, white — philosophy. While not wishing to deny its impressive explanatory capacities, I argue that something valuable is missed if we do not attend to the equally powerful rhetorical dimensions of the text. To that end, I examine the ways "The Racial Contract" seeks to induce a subjective change in its white audience, to transform complicity with a racial contract into a committed struggle to dismantle it. Ultimately, my considerations of "The Racial Contract" bear on the role of language and rhetoric in addressing white supremacy in the contemporary moment.
Faculty Sponsor: Arash Davari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COMPUTER SCIENCE II

OLIN 129

Nikhil Lonberg, moderator

Ema Di Fruscia, coach

10:45 a.m. MIKAELA SLADE, SAGE LEVIN, KAI MCCONNELL, SEAN MILLER, Interactive Campus Map

Our group designed several new features for Whitman's interactive campus map. This prototype provides a framework for users to identify the area's significant trees and enjoy historical tree tours. The tree tour feature uses data from the college's Trees and Landscaping Committee to document various species of trees and explain their historical significance. Future iterations of the campus map based on our platform may include a guide to campus art tours as well as the location of campus amenities such as bike racks, bike repair stations and water fountains. In our presentation, we explain the process that we implemented in building these features, the interactions we had with campus stakeholders, and possible additions inspired by the University of Oregon's campus map.

Faculty Sponsor: Janet Davis

11:15 a.m. NIKHIL LONBERG, BEN ADAMS, GEORGE ASHLEY, COOPER LAZAR, Video Manipulation

This presentation of our Computer Science capstone is the culmination of a year of research and development in software engineering and experimentation in visual arts. We collaborated with Associate Professor of Art Justin Lincoln to expand his explorations of sound and video. Our product allows for manipulation of video, sound and geometric designs across multiple planes in 3-D space. In applying engineering principles to the visual arts, we tested the limitations of the programming language, Processing, as a video manipulation tool. Our project is intended to aid Lincoln's experiments with space, sound and time, and to inform the Processing community about useful applications of object-oriented design in video manipulation. Attendees of our presentation need not have technical experience; the details of our project are accessible to all who are interested in visual arts and human-computer interactions.

Faculty Sponsor: Janet Davis

GEOLOGIC SURVEYS

SCIENCE 159

Christoph Suhr, moderator

Emma Cooper, coach

10:45 a.m. MCKENZIE ELLIOTT, Solving Archaeological Mysteries Through Paleoclimate Investigation

The Peloponnese peninsula in southern Greece accommodated many ancient civilizations, including Mycenaean culture, the Roman Republic and the Byzantine Empire. Sparta, Corinth, Argos and Megalopolis thrived there. In addition to the historical record of the Peloponnese, cave and lake sediments in the region have accumulated deposits that are potential archives of paleoclimatology data. Multiple studies have been conducted of paleolake sediments across the peninsula to better understand the causes of the simultaneous collapse of ancient societies in the area. Could regional climate change be a cause? Paleoclimate studies may be able to solve this mystery. My research employed chemical analyses and grain-size analysis of sediment cores to determine if climate may have caused destabilization across the region. I share the results of that investigation in my presentation.

Faculty Sponsor: Nick Bader

11 a.m. KEIFER NACE, Vegetation and Lithology Response to the Paleocene-Eocene Thermal Maximum in the Hanna Basin, Wyoming

The Paleocene-Eocene Thermal Maximum (PETM), a rapid global warming event ~56 Ma caused by a large release of isotopically-light carbon into Earth's atmosphere and oceans, provides geologic parallels to anthropogenic climate change. My study compares vegetation changes within three channel and overbank depositional sequences before, during and after the PETM in the Hanna Basin, Wyoming. At each site, I assessed vegetation structure using reconstructed leaf area index (LAI) measurements, which range from 0 (open landscape) to 6 (dense canopied forest). Pre-PETM, the average LAI value was 4.22 (± 2.0), while the average during the PETM was 3.5 (± 1.9). Post-PETM measurements gave the highest LAI average of 5.5 (± 2.0). My results indicate densely forested environments during the late Paleocene, giving way to more open landscapes during the PETM. Post-PETM sites show the densest canopies. Variation in LAI values reveals that the PETM had a significant impact on terrestrial landscapes.

Faculty Sponsor: Pat Spencer

11:15 a.m. LAURA BEDOYAN, Did the Lithosphere Drip Under Northeastern Oregon?

Over 16 million years ago the Columbia River Basalt Group (CRBG) erupted and became one of the most extensive continental flood basalts in the United States. Its source is hypothesized to be the Yellowstone hotspot, but others contest that the rip or drip of the lithosphere also contributed. Erupting contemporaneously with the later CRBG are olivine basalts, which have a greater density and are rich in olivine crystals. High traces of chromium in the olivine basalts suggest a mantle-like source for the CRBG. At 11 kilobars (~43 kilometers depth), the calculated densities of anhydrous magma are 2.85 g/cm^3 for the olivine basalt. However, hydrous olivine basalt (ρcalc = 2.52-2.55 g/cm^3) become saturated at shallower depths (1.5-3 kilobars). This lower density could enable its upward migration and eruption particularly if aided by delamination and partial melting of the lower 10 kilometers of the lithosphere beneath the Wallowa Mountains.

Faculty Sponsor: Kirsten Nicolaysen

11:30 a.m. CAIT MAZZOLENI, Grain-Size Distributions of Soils, Tephras and Culturally-Modified Sediments Show Prehistoric Human Resilience to Geologic Processes in the Islands of Four Mountains, Alaska

Subarctic conditions of the Islands of Four Mountains (IFM) in the Aleutian archipelago challenged long-term prehistoric human occupation. This dynamic coastal environment is prone to volcanism, earthquakes, tsunamis, changing sea levels, glaciation, and paraglacial processes. From circa 3,800 calendar years before present to 1741 CE, the Unangan (Aleut) people built semi-subterranean houses in sediment fans on Carlisle and Chuginadak islands among volcanoes with Holocene activity. My presentation explores grain-size signature as a tool for interpreting human interaction with the IFM environment. I performed grain-size analysis of fine sediment fractions from three sediment profiles at village sites and one natural sequence. Using these data, archaeological records and field observations, I attribute geologic processes to each layer. Layers may be distinguished between those with past human occupation (cultural layers), tephras and debris flows. These evaluations can be compared with initial field interpretations and used to categorize strata of previously unknown origins.
Faculty Sponsor: Kirsten Nicolaysen

11:45 a.m. CHRISTOPH SUHR, Desert Islands: Examining the Formation of Isolated Colluvial Outcrops in Drylands

On hillslopes in the Mojave Desert and the Sandia Mountains, isolated "islands" of thick colluvial deposits are juxtaposed with the thin soils of nearby slopes. Colluvium, the unconsolidated material that mantles bedrock on hillslopes, is generally formed via weathering of the underlying bedrock. Additionally, fine wind-blown dust can be trapped and incorporated into the colluvial material. Colluvial thickness on hillslopes is controlled by the mass-balance of colluvial material; addition occurs through weathering of the underlying bedrock, and trapping and storing aeolian material. Traditional hillslope-process literature suggests that colluvial thickness will remain consistent, with increases in surficial erosion mitigated by corresponding increases in colluvium production through bedrock weathering. In my presentation, I examine the timing and processes of these colluvial islands' formation to show hillslope colluvial mantles to be dynamic features, susceptible to periods of deposition and erosion linked to climatic variability.
Faculty Sponsor: Lyman Persico

SPECIES, EVOLUTION, ADAPTATION

SCIENCE 100

Abbey Dias, moderator
Lilly Calman, coach

10:45 a.m. WILLA JOHNSON, Diet Variation of Age-0 and Age-1 Sablefish in Southeast Alaska

Sablefish (Anoplopoma fimbria) are a commercially important groundfish in Alaska. These fish spend the first two years of their lives in nearshore marine environments, which is a critical time for feeding and growth. In my presentation, I compare the diets of age-0 and age-1 sablefish in order to examine differences in diet between two size classes. My research group caught sablefish in Southeast Alaska in October of 2017 and collected their stomach contents. Sablefish are generalists and consume a wide variety of prey; amphipods, mysids, and fish, specifically Pacific herring and salmon, were the most common prey items found across both size classes. Larger sablefish had diets with greater taxonomic diversity and relied more heavily on eating other fish. A greater understanding of the juvenile sablefish diet can yield insight into managing sablefish stocks and help increase sablefish abundance.
Faculty Sponsor: Tim Parker

11 a.m. FRANKIE GERRATY, Pacific Lamprey: A Case Study of Extinction, Collaboration and Life in the Anthropocene

The Anthropocene is an epoch of life and death, exponential growth and colossal decay. The human population, along with the economy and concentration of atmospheric carbon dioxide, appears to be on a track of tumorous growth. Multispecies life-support systems that humans depend on teeter at the brink of oblivion. In my presentation, Pacific lamprey serve as our guide as we wade through the entangled cultural and natural histories of Mill Creek and the greater Columbia River watershed. Informed by an internship with the Pacific lamprey restoration program at Walla Walla Community College and by personal investigation, my presentation reveals threats of extinction, multispecies collaborations, and possibilities for more-than-human life in the Anthropocene.

Faculty Sponsor: Susanne Altermann

11:15 a.m. THOMAS MEINZEN, Birdsong Evolution: Avian Vocalization Frequencies Reflect Adaptation to Habitat Structure

Acoustic signals are essential for communication, advertisement and reproduction in many species. However, their successful transmission is limited by the environment. My research investigates the acoustic adaptation hypothesis, which proposes that, to maximize transmission efficiency, animals evolve vocalizations with characteristics that minimize degradation and attenuation (loss of volume) in their native habitat. This hypothesis predicts that birds of open habitats will have vocalizations with higher frequencies and larger frequency ranges than birds of forest understory habitats, because fewer obstructions and greater low-frequency ambient noise in open areas favor transmission of high-frequency signals. I tested this prediction by recording and analyzing vocalizations of 63 bird species living in open and forested habitats around Monteverde, Costa Rica. I found that, on average, birds of open habitats vocalized at significantly higher frequencies than birds of forested habitats, suggesting that vocalization transmission efficiency helps shape avian communities and their response to habitat transformations.

Faculty Sponsor: Tim Parker

11:30 a.m. ABBEY DIAS, Evolution of Bone Density in Deep-Sea Snailfishes

Maintenance of neutral buoyancy is a challenge to all fishes, but extreme environmental conditions exert

exceptional evolutionary pressures on species residing in the deep sea. With the elimination of swim bladders, a reduction in skeletal structure has become the mechanism by which some deep-sea fish achieve the buoyancy needed to hunt in the water column. The family Liparidae (snailfishes) spans the largest depth range of any marine fishes, and includes hadal snailfishes found at depths of ~8,200 meters. We used micro-computed tomography (micro-CT) scanning to study the density of five bones associated with certain biological functions. We studied 32 specimens from across the Liparidae phylogeny and bathymetric range. Analyses revealed a decrease in bone density with increasing depth. The degree of change in density with depth differed among the structures measured, implying evolutionary effects on the function and performance of bone structures in the deep sea.
Faculty Sponsor: Ginger Withers

THE ARTS
KIMBALL THEATRE
Missy Gerlach, moderator
Willa Johnson, coach

10:45 a.m. CLAIRE PEPPLE, Rewritten: Gothic Heroines and the Roles They Fill

My presentation, based on research I conducted on British Gothic literature, compares Horace Walpole's "The Castle of Otranto" with Ann Radcliffe's "A Sicilian Romance." The new purpose for feminine characters that Radcliffe establishes comes in the form of mental perseverance, bodily mobility, and emotional maturity. Julia, the melancholic and at times misunderstood heroine in "A Sicilian Romance," foils Walpole's Isabella as a Gothic daughter. Her journey, however, gives the reader newfound respect for the women who embody their own fantasies of escape from confining relationships and patriarchal structures. The space Radcliffe creates for Julia to gain agency in "A Sicilian Romance," within her family, her flight and her struggle for empowerment, reworks Gothic tropes to encourage the questioning of female roles within the British Gothic novel.
Faculty Sponsor: Sharon Alker

11 a.m. ELSA HAGER, Gershwin's "An American in Paris": A Performance History

American composer and pianist George Gershwin (1898-1937) is best known for his Broadway show tunes. Yet, Gershwin also wrote several ambitious symphonic works, including "An American in Paris" (1928). True to its name, "An American in Paris" is a programmatic piece meant to depict the experience of an American tourist strolling Parisian streets. The original piano roll of "An American in Paris" and the 1929 radio premiere, which Gershwin oversaw, help paint a picture of the composer's original intentions for the work. Various performance choices made then and over the years shape our conception of the work and its identity. In my presentation, I analyze "An American in Paris" and recordings of performances to construct a performance history of the work. My research will show the evolution of performance choices of "An American in Paris" throughout its history.
Faculty Sponsor: Paul Luongo

11:15 a.m. NATHAN KREBS, Foley Moly: Reality and the Irrational in Film

Film viewers rarely pay attention to the sound of footsteps, clothing and squeaky floorboards. Yet, these and other sounds provide crucial support to the story being told, and it is through Foley (named after sound-effects artist Jack Foley) that they exist. To enhance the auditory experience of a film, Foley sound artists re-create, in post-production, the realistic ambient sounds that a film captures. My presentation explores the role of Foley in determining the relationship between reality and the irrational in films such as Hayao Miyazaki's "Spirited Away" and Henry Selick's "Coraline." Directors typically use Foley in real-world settings to aurally support the reality of the environment shown on screen, while music highlights otherworldly events. The interaction of Foley with irrational elements of films can blur our understanding of what is and what is not reality, effectively altering our comfort level with these ideas.
Faculty Sponsor: Paul Luongo

11:30 a.m. MISSY GERLACH, German Film Adaptations: Texts in Transformation and Conversation

Filmmakers have long drawn inspiration from literary texts. As a result, film adaptations are often judged by their fidelity: how "faithful" the film is to its source (novel, short story, etc.). The field of adaptation studies circumvents the question of fidelity by recognizing a film on its own merits in its own genre, existing in relation to, but not dependent on, its literary source. In so doing, a fruitful examination occurs, one that connects two distinct, equal works and considers how they engage conceptually with each other. My presentation investigates how the German films "Er ist Wieder Da" and "Der Himmel über Berlin" use voice-overs to engage with their source texts, either by contributing to a pre-existing interpretation of the text or presenting an alternative perspective.
Faculty Sponsor: Emily Jones

SESSION 3
3-4:15 p.m.

ENVIRONMENTAL JUSTICE
OLIN 138
Amanda Champion, moderator
Erick Franklund, coach

3 p.m. ELLIE TEARE, CLAIRE PINGER, NICK RAPP, Freiburg: Green City

Our presentation examines the social and political conditions that led to the rise of environmentalism in Freiburg, Germany, a city whose ambitious sustainable development initiatives have earned it the title "Green City." The green urban planning in Freiburg serves as an exemplary framework of individual and institutional environmentalism working in concert and common purpose. Our presentation calls attention to several successes in the sustainable development of Freiburg, including the restoration of the Dreisam River, an extensive public transportation system, and advanced building standards.
Faculty Sponsor: Donald Snow

3:15 p.m. KAELEY PILICHOWSKI, Plastics, People and the Ocean: Why Should We Care About a Turtle Swallowing a Plastic Bag?

The health of the earth and its marine environment is crucial to human survival. However, the mass production, use and disposal of plastics around the world is harming this environment. This exploitation and abuse of global natural resources is often tied to the belief that there is a divide between humans and the environment. Technological and social changes have distanced humans from nature, allowing us to think we are unaffected by our negative impact on the environment and justifying the continued mistreatment of the natural world. In my presentation, I explore the public's knowledge of plastics, the effect of plastic on human and marine health, and attitudes and behavior relating to the consumption of plastics. Lack of knowledge of plastics threatens our oceans and the earth. My research may provide tools to improve the health of the marine environment, and in turn, human health.
Faculty Sponsor: Alissa Cordner

3:30 p.m. CHLOE CAROTHERS-LISKE, Local Attitudes Toward Conservation Initiatives on South Caicos and East Caicos

South Caicos and East Caicos are two small, relatively undeveloped islands in the Caribbean. Their economies rely heavily on tourism and fishing, and questions about the impact of these growing industries on the environment must be asked. In my presentation, I discuss the attitudes of South Caicos residents toward protected areas, development projects and ecotourism on South Caicos and East Caicos. My findings are based on interviews with business owners, fishermen and community leaders. Many residents have concerns about potential environmental impacts from future development. At the same time, a significant number of respondents believe that ecotourism is a viable alternative to larger tourism tied to development. Respondents have mixed attitudes about the purpose and effectiveness of marine protected areas (MPAs), especially in relation to the fishing industry. The attitudes of local residents may provide insight into the future success of conservation initiatives.
Faculty Sponsor: Gilbert Mireles

3:45 p.m. AMANDA CHAMPION, A Conservation Quandary in Madagascar

The island of Madagascar has long been a priority for international conservation efforts due to its astonishing biodiversity and endemism. As its government struggles to meet the needs of one of the poorest populations by GDP in the world, the international community has a strong hand in these efforts. Non-governmental organizations from abroad manage many protected areas. As a result, the need of local people to use natural resources is often pitted against international initiatives to protect rare species. My presentation focuses on research I conducted on the endangered endemic tree species *Delonix velutina* (Fabaceae), found in the northern part of the country, and its management by Missouri Botanical Garden. My work offers a small case study of the dynamics that govern the ways by which the Malagasy people interact with the species they have lived among for thousands of years.
Faculty Sponsor: Susanne Altermann


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MODES OF BEHAVIOR

OLIN 129

Ashley Weibel, moderator

Matthew Schetina, coach

3 p.m. NICKI CADDELL, Tolerance as an Imposition

The term "tolerance" is everywhere in current political and social discourses. Plastered on bumper stickers and used in political slogans, tolerance has become a value that many see as distinguishing them as cosmopolitans, or "citizens of the world." But are those who affirm tolerance truly cosmopolitan? How did tolerance come to have the positive connotation that it does? Using political theorist Wendy Brown's critique of tolerance from "Tolerance As/In Civilizational Discourse," I offer an analysis of Martha Nussbaum's proposed "cosmopolitan education" as an example of what Brown finds to be problematic. I argue that Nussbaum's model, while appealing, fails to recognize the way in which it imposes a Western schema and value that is, despite its cosmopolitan aspirations, intolerant.

Faculty Sponsor: Julia Ireland

3:15 p.m. CAMERON CONNER, Cosmopolitanism: Universality and the Modern Tribe

Cosmopolitanism is one way to address Dr. Martin Luther King's ultimatum that "we must either learn to live together as brothers, or we are going to die together as fools." My presentation is intended to communicate the virtues of a cosmopolitan ethic. I seek to better ascertain how the human race can establish an ethos by which we are able to coexist — as we do — in a world of strangers. I examine the writings of Kwame Anthony Appiah and Immanuel Kant in order to evaluate the role of universal principles. The dialogue between Appiah and Kant upholds the virtue of conversation over the imposition of reason, of engagement rather than assumption, and thereby seeks to articulate the ways in which such a philosophy is relevant to the 21st century.

Faculty Sponsor: Julia Ireland

3:30 p.m. BRYN HINES, The Implications of Culture

My presentation considers political implications of "culture," drawing from contemporary critique of the term in anthropological literature. I discuss how culture is often racialized and used in a manner that indexes the "other." I also explore how culture is introduced to explain particular forms of behavior as opposed to others — behavior often deemed irrational or pathologized. For instance, particular groups of people are often considered to be of a more cultural nature, while others are depicted as neutral or acultural. Such division is often constructed along racialized lines. Often culture is also presented as entirely separate from political or economic domains and thus is easily essentialized into a bounded, static entity. My presentation examines culture as a commonly used term with complex, often ambiguous implications — implications that often feed into processes of racialization.

Faculty Sponsors: Rachel George and Jason Pribilsky

3:45 p.m. ASHLEY WEIBEL, The Relation Between Bilingual Education and Children's Intergroup Attitudes

At a time when nationalism, xenophobia and racially-motivated discrimination are increasing, anti-prejudice interventions are needed more than ever. Previous research suggests that bilingual education is linked to reduced prejudice toward members of racial and ethnic minority groups. However, this connection is not firmly established, and the effects remain unclear. My presentation examines the relationship between education type and attitudes among white fourth- and fifth-graders toward Latino children. I hypothesize that students in bilingual programs have more positive attitudes toward Latino children than do students in English-only programs. I also explore the possibility that positive attitudes toward Latino children generalize to other minority groups such as Asian heritage children. Understanding the social impacts of bilingual education will extend evaluations of this educational model beyond academic outcomes. Crucially, results will inform the design of effective prejudice-reduction interventions.

Faculty Sponsor: Matthew Prull

BRAIN MATTERS

SCIENCE 159

Lauren Wilson, moderator

Sarah Rothschild, coach

3 p.m. NATALIE MUTTER, The Renaissance Cell: Microglia in the Learning Brain

More types of cells than just the neuron play crucial roles in building and maintaining the living, learning brain. Microglia have come to light as essential contributors to brain health. These small, branching cells respond to injury and surveil surrounding tissue for potential threats to the central nervous system. However, microglia are not simply effective watchdogs — they also play an active role in restructuring synapses during development. I was especially curious to see what changes occur in microglial populations as an animal engages with and learns in its environment. To test this, I analyzed brain tissue of rats housed in both simple and complex environments to understand how these conditions impact density and morphology of microglia in rat visual cortex. I used quantitative confocal microscopy to analyze size and complexity of microglial cells in hopes of shedding further light on the effect of environmental conditions on brain plasticity.

Faculty Sponsors: Ginger Withers and Chris Wallace

3:15 p.m. MAEGEN MARTIN, CHELSEA DAY, JILL LOW, Effects of Mindfulness on the Flow State in Division III Varsity Athletes

Sports psychology aims to enhance athletic performance. Previous research has examined the role of flow, a mindset of complete immersion in the task at hand and the ability to tune out surrounding distractions. Our presentation examines the relationship between mindfulness and flow in collegiate varsity athletes in winter and spring sports. We hypothesize that increased time engaged in mindfulness meditation (using the Headspace smartphone application over a three-week period) is associated with increased mindfulness and flow states. We also expect that participants in the control condition who listen to relaxing music show no change in mindfulness and flow state. Our results can inform athletes of ways to enhance their athletic performance.
Faculty Sponsor: Matthew Prull

3:30 p.m. KATIE DAVIE, NATALIE THIEL, Are Psychopaths Suicidal?: Effect of Triarchic Psychopathy Factors on Externalizing Psychopathology and Suicidality

Societies have long been fascinated by psychopathy, specifically in how profound psychological disorder may lurk beneath the appearance of normalcy. The modern conception of psychopathy — superficial charm concealing interpersonal deficits and behavioral deviance — is widely accepted, but experts disagree over the scope of the disorder. Many current models are limited in recognizing relationships between psychopathic facets. The triarchic model characterizes psychopathy through three phenotypic facets (disinhibition, boldness and meanness) and may better identify which characteristics relate to maladaptive behaviors such as suicide. Our presentation examines whether disinhibition, associated with impulse control and drug problems, positively correlates with increased suicidality, and if boldness, associated with high stress tolerance, is a protective factor against suicidality. Meanness has little apparent relationship with suicidality but may interact with boldness and disinhibition to affect diagnostic outcomes. Our study seeks to contribute to a nuanced understanding of psychopathy and its facets.
Faculty Sponsor: Stephen Michael

3:45 p.m. LAUREN WILSON, How Intellectual Love Shapes Scientific Investigation

Scientific investigation is fundamentally shaped by the kinds of questions asked. Scientists guided by a love of knowledge seek to learn about a particular subject purely for the purpose of gaining knowledge, sometimes at the expense of their subject. The scientific answer to the question "How old is this tree?" can only be found by causing the organism's death. Other scientists are guided by love of a particular subject. Jane Goodall exemplifies this kind of love in her study of chimpanzees; Goodall loved the chimpanzees first, and the knowledge about them secondarily. In my presentation, I focus on Italian physician and educator Dr. Maria Montessori, who distinguishes between these types of investigations and builds her pedagogical method to emphasize the latter: intellectual love. This focus in scientific inquiry is shaped by the virtue of intellectual love, or "love of environment," which makes a child "interested in everything."
Faculty Sponsor: Patrick Frierson

PLANT SCIENCE

SCIENCE 100

Grant Gallaher, moderator

Natalie Mutter, coach

3 p.m. LIZA BRIODY-PAVLIK, RALPH HUANG, Influence of LMWOAs on Disjunctive Ligand Exchange Pathways

Metals are essential micronutrients for plants. The concentration of available metal in the soil around roots is often low and growth-limiting. A variety of graminaceous plants exude phytometallophores and low molecular weight organic acids (LMWOAs) to bind metals and assist in their uptake. The role of LMWOAs in these ligand exchange pathways is mostly unknown. We used a model ligand exchange pathway to monitor the rate of transfer of nickel. We hypothesize that LMWOAs accelerate the dissociation of an initial ligand-metal complex, and enhance overall reaction rates. We examined two sets of LMWOAs that are structurally related to oxalate, a common plant exudate, one set with differing ligand donor groups and the other with increasing numbers of carbons between the carboxylate groups. We describe a structure-reactivity relationship that explains how LMWOAs affect the reaction. Our work has implications for a better understanding of bioavailability of metal micronutrients in the environment.
Faculty Sponsor: Nate Boland

3:15 p.m. ZAYNAB BROWN, Analysis of Seed Set, Grain Development, and Moisture Changes Through Time of Intermediate Wheatgrass

The use of perennials as alternatives to common annual crops represents an opportunity to address many problems associated with modern agricultural practices, including soil degradation, fertilizer leaching and water efficiency, while providing services such as carbon sequestration and wildlife habitat. Intermediate wheatgrass *(Thinopyrum intermedium)* is a domesticated perennial grass bred for grain yield. Identifying the optimal harvest time for intermediate wheatgrass (IWG) requires an understanding of seed moisture and shattering — dispersal of seeds — throughout the growing season. I collected data on seed and spike moisture content, floret utilization, and shattering of IWG in variably-aged plots managed with and without plant growth regulators. My study analyzes the correlation between seed and spike moisture over time and the pattern of floret utilization and shattering along the spike. Understanding how moisture, shattering and floret utilization varies over time can help create a simple, in-field method to determine harvest time for growers.
Faculty Sponsor: Susanne Altermann

3:30 p.m. WALKER ORR, Terroir for the 21st Century: Breeding for Flavor

Despite recent negative reports in the press, wheat remains a key staple food on the planet. Wheat breeding in the past century has greatly increased yields, contributing to global food security, but production has come at the expense of nutrition and flavor. A growing movement of plant breeders, farmers and processors have concluded that flavor is the element that ties consumers to producers and serves the environmental, social and health-related goals of local food movements. Why not select for flavor and nutrition as well as for yield and hardiness? In my presentation, I argue that nutrition and flavor will be seen in the future as essential factors in the selection of crops in field trials because both elements tie the goals of agricultural research to initiatives that are regionally specific and culturally valuable.
Faculty Sponsor: Aaron Bobrow-Strain

3:45 p.m. ASHLEY PERSON, Petal Anthocyanin Evolution by R2R3 MYBs in *Mimulus cupreus* and *Mimulus luteus* var. *variegatus*

Repeated evolution refers to independent gain of a single trait by multiple related taxa. Studying examples of repeated evolution can elucidate patterns in how molecular mechanisms cause phenotypic change. In Chilean monkeyflowers *(Mimulus)*, petal lobe anthocyanin pigmentation has been gained independently by three taxa: *Mimulus luteus* var. *variegatus*, *Mimulus cupreus*, and *Mimulus naiandinus*. Anthocyanins give the flowers of these taxa an orange or purple color, while other Mimulus taxa have yellow flowers. One hypothesized mechanism for the gain of petal anthocyanin expression is through changes in R2R3 MYB transcription factors, which act as activators in the anthocyanin biosynthetic pathway. My presentation explores how the expression of one MYB candidate gene in *Mimulus luteus* var. *variegatus* and two in *Mimulus cupreus* contribute to petal color phenotype.
Faculty Sponsor: Arielle Cooley

4 p.m. GRANT GALLAHER, Melastomataceae Diversity and Abundance Along an Elevational Gradient of an Andean Ecological Corridor

I present a baseline assessment of the plant family Melastomataceae along an elevational gradient of the Llanganates-Sangay ecological corridor in central Ecuador. Conservation efforts within this corridor aim to preserve the high levels of diversity and endemism present in the region. Melastomataceae, as the third most diverse plant family in Ecuador, contributes valuable biodiversity, biomass, and ecological services to the ecosystems of this corridor. My findings reveal a positive correlation of melastome diversity and abundance with elevation up to 2,500 meters. At 3,000 meters, species diversity decreases sharply, but total abundance remains high. Similarity indices indicate dramatic changes in melastome community composition over even slight differences in elevation. Eighteen species of flowering melastomes belonging to four genera were found. The results of my study will be used to inform future conservation efforts

and ecological studies in this incredibly unique and important Andean corridor.
Faculty Sponsor: Susanne Altermann

COMPOSERS STUDIO
KIMBALL THEATRE
Thomas Meinzen, moderator
Anthony Reale, coach

3 p.m. BRYCE WEBER, "Conversations"

In one sense, nothing that we create or express is truly original. Our beliefs, ideas, and thoughts are informed by remnants from our interactions with others. I had this perspective in mind as I wrote the three-movement piano piece, "Conversations." The first movement, "Dialogue," captures the interdependent nature of conversation. People talk and act differently around different people; I weave two themes of distinct but compatible nature to create moments of curiosity and spontaneity. The second and third movements, "Monologue, Part I" and "Monologue, Part II," contrast with the first. When left to ourselves, we continue to communicate internally, asking our most important questions. The simple, repetitive melody in "Monologue I" is meant to convey a continuous train of thought. In "Monologue II," the music takes a dramatic turn, yet the original melody remains, paying tribute to its origin. Before performing the piece, I will present a brief musical analysis.
Faculty Sponsor: John David Earnest

3:15 p.m. KIRK LANGE, "Oregonian Suite"

"Oregonian Suite" is a four-movement character suite for solo piano that paints images of various locations in my home state of Oregon. The first movement, "Heceta," depicts crashing waves on the rocky Oregon coast through its stormy, wave-like bass line. A gentler second section lightens the atmosphere; the weather on the Oregon coast does have intermittent moments of calm. "Eugene" mimics the sensation of a large group run with its faster tempo and wandering, chromatic key changes. "Clear Lake" is about tranquility; the lake is nestled in the Cascade Mountains and is surrounded by several miles of forest. Motorboats are banned here, making it a peaceful destination. The final movement, "Belknap Springs," though not as ferocious as the first movement, returns to the theme of moving water, conjuring bubbling hot springs and the gentle rapids of the McKenzie River.
Faculty Sponsor: John David Earnest

3:30 p.m. CORY COGLEY, "Fantasy Macabre"

Programmatic music is so ingrained in musical culture that listeners and composers alike are hard-pressed to imagine music without an underlying meaning. Music frequently evokes themes and moods of humanity and nature; composers impose structure to balance abstract thought. Free-form genres as represented in my "Fantasy Macabre" allow creative freedom for both composer and listener. The piece suggests a dark tale of horror and mystery. The audience is free to experience the complex structure of the composition as spontaneously as do the performers, compelled to interpret the chaotic world around them. The chaos in my composition is not only structural but also sonic in the arrangement of saxophones and strings. Four instruments in each group present a kaleidoscopic whirl of musical ideas, lyrical and aggressive.
Faculty Sponsor: John David Earnest

3:45 p.m. THOMAS MEINZEN, "Songs from the World Around Us"

"Songs from the World Around Us" explores the intersection between humans and the natural world through music. This original composition calls attention to sound as an intimate avenue into understanding, relating to, and finding beauty in our environment. Weaving together a variety of human and environmental sounds, from Walla Walla traffic and footsteps to Costa Rican birdsong, my piece addresses the growing separation between humans and nature and promotes the act of listening to reintegrate the natural world into our daily lives. Before presenting my composition, I will briefly describe the genesis of the piece, its design, and the part it plays in a larger written work, a thesis which concerns the power of sound to reconceptualize human-nature relations.

Faculty Sponsor: John David Earnest

DISEASE, CARE AND CURE

REID G02

Molly Burchfield, moderator

Caroline Bauwens, coach

3 p.m. AARON RODRIGUEZ, Beta-1 Adrenergic Signaling Protects Against 6-OHDA-Induced Cytotoxicity in Differentiated SH-SY5Y Dopaminergic Cells

Parkinson's disease (PD) is a neurodegenerative disorder associated with death of dopaminergic neurons in the substantia nigra (SN). In this study, I attempt to understand why the SN, rather than other parts of the brain, is predisposed to develop PD. The SN has a high density of beta-1 adrenergic receptors (B1-AR) that can stimulate mitochondrial fission, which is associated with cell death. I hypothesize that B1-AR-induced mitochondrial fission is the principal mechanism for the unique vulnerability of the SN to PD. I differentiated SH-SY5Y cells into dopaminergic neurons and treated them with beta blockers before exposing them to the neurotoxin 6-OHDA for 24 hours. To assess cell death, I performed an enzyme-linked immunosorbent assay to measure apoptotic markers. I found that treatment with the beta blocker Metoprolol exacerbates 6-OHDA-induced cell death, indicating that B1-AR signaling and subsequent mitochondrial fission may be conserved due to their protective role during 6-OHDA-induced toxicity.

Faculty Sponsor: Michael Coronado

3:15 p.m. CHRIS SIMPKINS, Evaluation of the Efficacy of Broadly Neutralizing Antibodies in the Treatment and Prevention of HIV-1 Infection

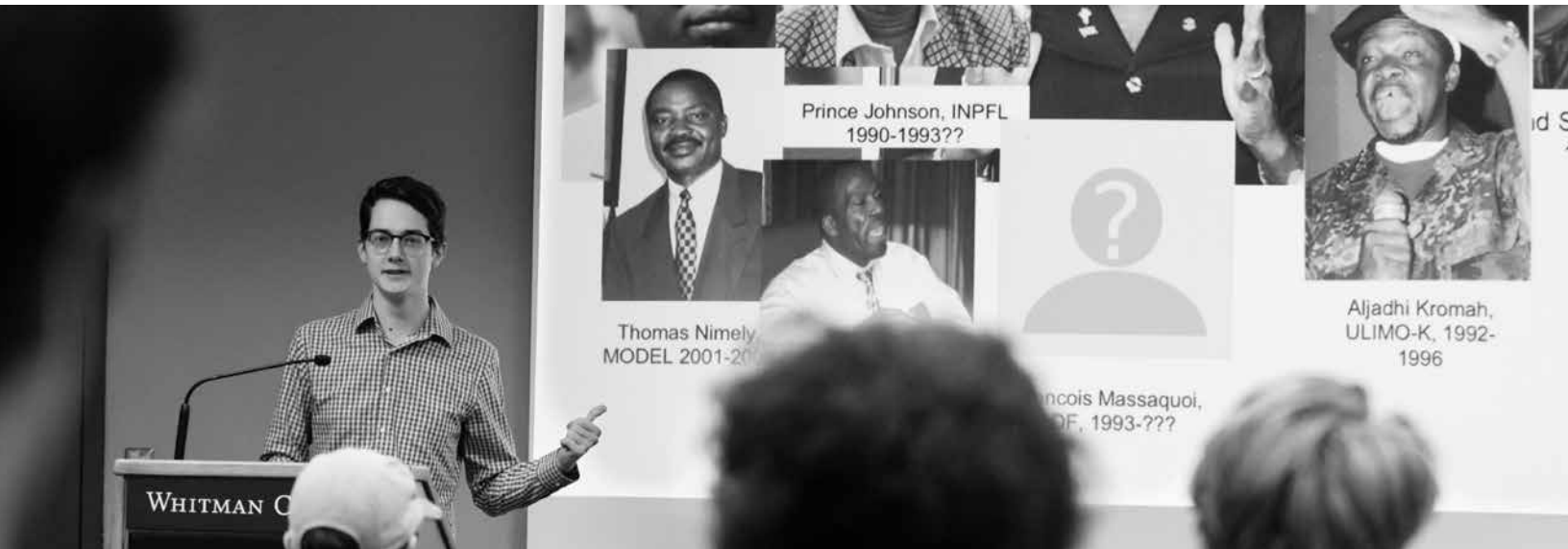
Broadly neutralizing antibodies (bnAbs) are proteins that prevent HIV entry into host cells and promote the destruction of HIV particles by the immune system. BnAbs that target diverse viral epitopes are currently being evaluated in global clinical trials for the treatment and prevention of HIV infection. Data from these trials are compiled into publicly-available databases and include information such as viral genetic sequence, region of isolation, viral subtype, and the potency of selected bnAbs to neutralize HIV. My project uses RStudio to compile, manipulate and visualize these data to discover how bnAbs differentially neutralize genetically distinct viruses. I found that even single amino acid residue changes can drastically influence bnAb efficacy and that geographic region and viral subtype should be considered during treatment selection. My research illuminates the need for intentional and informed treatment and helps identify and mitigate the obstacles arising from the immense genetic diversity inherent to HIV.

Faculty Sponsor: Elizabeth Danka

3:30 p.m. MOLLY BURCHFIELD, SIENNA RAHE, Magical Plants and Modern Painkillers: Documenting Medical Pluralism in Rural Cambodia

Some 30 years ago, indigenous healers served as primary healthcare providers for 90 percent of the world's population. In the ensuing generation, Western medicine's reach and influence has spread far and wide. Traditional medicine persists, albeit tenuously, in rural Cambodia. We use our presentation to share stories and accounts from interviews with more than 50 residents of Cambodia's most sacred national park, Phnom Kulen. In this rural jungle setting, people spoke about navigating between traditional and Western medicinal resources, issues of access and financial equity, and the plant *protiel* that lies at the root of the country's spiritual-religious healing. We discuss the intersections of "modern" and "indigenous" healthcare systems, the documentation of local knowledge, and the magical plants that, if used correctly, can freeze a thief in his tracks.

Faculty Sponsor: Pat Spencer



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OFF-CAMPUS STUDY PROGRAMS

Molly Burchfield and Sienna Rahe
SFS: Cambodia Conservation, Ethics, and Environmental Change

Chloe Carothers-Liske
SFS: Turks and Caicos Marine Resource Studies

Amanda Champion
SIT: Madagascar Biodiversity and Natural Resource Management

Grant Gallaher
SIT: Ecuador Comparative Ecology and Conservation

Lian Gamble
SFS: Cambodia Conservation, Ethics, and Environmental Change

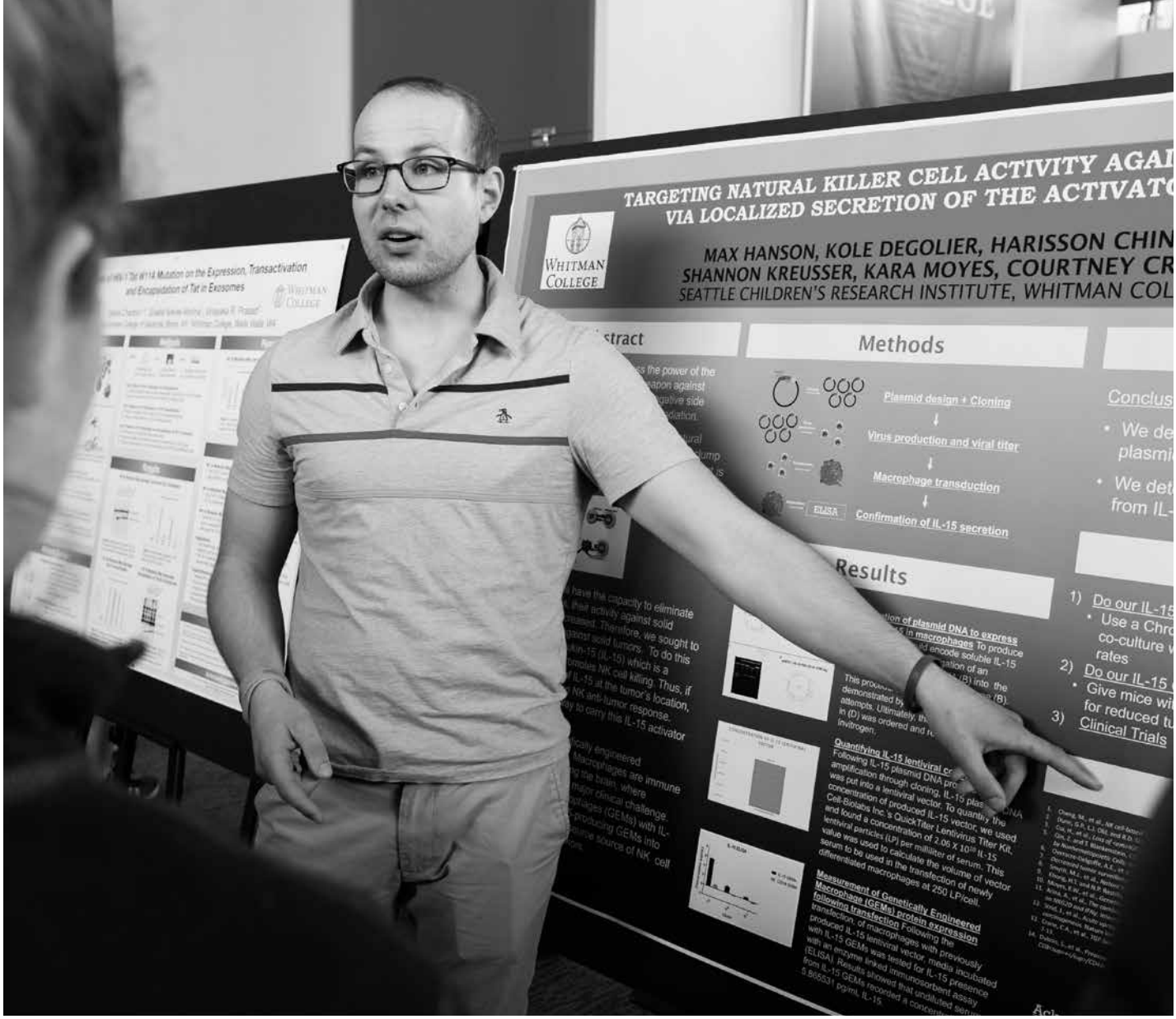
Frankie Gerraty
SFS: Panama Tropical Island Biodiversity Studies

Thomas Meinzen
CIEE: Monteverde Tropical Ecology and Conservation

Katie Sisson
SFS: Panama Tropical Island Biodiversity Studies

Sarah Smith
SIT: Ecuador Comparative Ecology and Conservation

Ellie Teare, Claire Pinger and Nick Rapp
IES: Freiburg Environmental Studies and Sustainability



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With special thanks to Jenny Stratton, Camden VanOcker, Robert Fricke, Amy Dodds, Doug Scarborough, Gary Gemberling, Whitman College Technology Services, Teresa Maddess and the staff of Bon Appetit, and the student musicians who share their art throughout the day.

UNDERGRADUATE CONFERENCE VENUES

1. **Cordiner Hall**
2. **Reid Campus Center**
   G02
3. **Hall of Science**
   100 (Brattain Auditorium)
   159
4. **Olin Hall**
   129
   138
5. **Hunter Conservatory**
   Kimball Theatre

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