

# **ABSTRACTS**

**Mount David Summit  
2018**



# The Mount David Summit

The Mount David Summit is an annual celebration of student research, artistic work, and community-based scholarship at Bates College. Each year students from all classes present their work to each other and to faculty, staff, family, and community members in a symposium format at the end of the winter semester. The Summit spotlights the rich and varied academic activities of Bates students across the disciplines and honors the vibrant intellectual life of the college.

Named for the landmark "mountain" on the campus, the Summit is guided by the motto of the college

—*Amore ac Studio*—

loosely translated, With Love and Zeal, With Ardor and Devotion:  
devotion to scholarship, creativity, and the life of the mind.

The Mount David Summit is sponsored by the Office of the Dean of the Faculty. We are grateful to Ralph T. Perry '51 and Mary Louise Seldenfleuer, who have been generous and devoted supporters of the Summit since its first year.

## ~ About the 2018 Summit ~

The 2018 Mount David Summit, held on March 23, features the research, creative work, and performances of students from all Bates classes. It is organized into four sessions, three in the afternoon and one in the evening. The summit program is published in this booklet; students' abstracts are available in a separate booklet or on the Web.

The faculty believes that all Bates students must develop as scholars in their own right, and be ready to articulate and defend their ideas in a public forum. The college's major programs of study, and especially the senior thesis/senior project requirement, are designed both to prepare students and challenge them to conduct original research or artistic work and contribute to our knowledge of the world. Many students who present their work at the Mount David Summit are senior thesis writers, approaching the summit of their academic career at Bates. Their presentation—which might be a research poster, a short talk, or a video documentary—represents hundreds of hours of work, remarkable commitment to their studies, and a synthesis of all that they have learned at Bates. Other presenters are at different points in this journey; they may be first-years just beginning to explore ideas in depth, or they may be sophomores or juniors in the process of developing the skills and insights that will serve their thesis work in the future. The artists who participate in the summit—the poets, fiction writers, essayists, dancers, actors, composers, musicians, ceramic artists, and photographers—bring to their work a combination of technique, cultural and intellectual context, ways of thinking and seeing the world, and raw talent that is nurtured in a liberal arts environment.

The kind of individualized education celebrated at the Mount David Summit would not be possible without the unflagging dedication of faculty advisors. Bates faculty work one-on-one with seniors on the thesis: In this process they are both demanding and supportive, guiding research methods, thoughtful interpretation, and effective writing. Many Bates staff members—assistants in instruction, lab technicians, writing and quantitative reasoning specialists, museum curators, theater designers, digital media specialists, librarians and archivists, and community-engagement staff—also work closely with student-scholars. These members of the Bates community offer a wide range of skills and expertise that enrich students' liberal arts experience.



## ~ ABSTRACTS ~

 indicates a presentation focused on environmental sustainability

**Paige Ahlholm '18**

***Effect of Collision Speed on Rate of Wing Wear in Bombus impatiens Bumblebees***

**Andrew Mountcastle, Biology, advisor**

Many flying insects accumulate irreversible wing damage over their lifetime, primarily caused by repeated collisions with vegetation. We investigated how collision speed, or wingbeat frequency, affects rate of wing wear. Using a high-speed motor, we artificially induced damage by forcing wings of *Bombus impatiens* bumblebees to collide with a leaf surface 500,000 times. We spun wings at three different speeds and measured the wingtip area remaining after each interval of 50,000 collisions. Wings spinning at the fastest speed experienced a higher rate of area loss per collision, and a greater overall area loss, than those spinning at slower speeds.

**Joseph Alp '18, Gabriella Chua '18, and**

**Kelly Wassarman '18**

***Designing TET Enzyme Inhibitors to Enhance Learning and Memory***

**Andrew Kennedy, Chemistry and Biochemistry, advisor**

Active DNA methylation in neurons that encode experiential learning is required for the formation of long-term memory. The TET family of enzymes are known to remove DNA methylation by detecting 5-methylcytosine and facilitating their oxidative removal via an Fe(II)/alpha-ketoglutarate-dependent mechanism. We hypothesized that learning causes long-term changes in gene expression in the hippocampus and facilitates long-term memory, because of active DNA methylation changes at plasticity-related genes. To test this idea, we sought tools to increase DNA methylation fidelity by inhibiting the function of the TET enzymes; however, there currently do not exist sufficiently potent TET enzyme inhibitors to serve as probes of memory function. Here, we describe the de novo design, synthesis, and evaluation of TET enzyme inhibitors. Using a combination of computational and traditional QSAR approaches we have developed small molecule inhibitors of the TET enzymes in the sub-micromolar range. Combined with proof of principle data acquired from the use of constitutive and conditional TET enzyme knockout mice in spatial memory tasks, these small molecule inhibitors of the TET enzymes may serve as therapeutics to enhance memory function in disease and disorders of memory.

**Garrett Anderson '18**

***Revolutionizing "Girl": Revolutionary Girl Utena's Portrayal of Adolescent Change against Normative Expectations***

**Brian Ruppert, Asian Studies and Japanese, advisor**

At the mark of its 20th anniversary, *Revolutionary Girl Utena*, a television anime series that initially aired in the 90s, has experienced somewhat of a revival, with a new blu-ray remaster, figures, and other content being released. The series' portrayal of normative breaking relationships and the consideration of these only continues to resonate, and despite 20 years passing, the themes *Utena* addresses may have never been more relevant. Using the trappings of a *shōjo* or young girl series a-la *Sailor Moon*, *Revolutionary Girl Utena* addresses a range of adult themes. This thesis aims to examine *Utena's* portrayal of adolescent change, particularly within the context of oppressive systems normative ideology in regard to gender and sexuality. The series portrays normative expectations of gender and sexuality as stymying adolescent change, employing stylized imagery and abstract symbolism to express these themes. Employing the lens of psychoanalytical film theory (Lacan, Mulvey, Žižek) and performativity (Butler, West, and Zimmerman), this thesis looks beyond the symbolic order to understand the Real as portrayed in *Utena*.

**Adair Andre '18, Marissa Bale '19, Elizabeth Eareckson '21, Katharine Gaillard '19, Nell Houde '18, and Sophie Landes '21**

***Sustainability Initiatives at Bates*** 

**Jane Costlow, Environmental Studies, advisor**

The EcoReps are students committed to environmental responsibility who work in with the college's sustainability manager, Tom Twist, to improve environmental systems and foster a culture of sustainability on campus. They will discuss sustainability efforts at Bates.

**Caroline Andy '18**

***Fluorescent Spatial Probing of B. burgdorferi Transcriptome Organization***

**Jennifer Koviach-Côté, Chemistry and Biochemistry, advisor**

Lyme disease is a rising public health concern, primarily in the Northeast. The mechanism of Lyme disease transmission, however, from *Borrelia burgdorferi*-infected ticks to vertebrate hosts, is largely unknown. My thesis serves to identify a procedure for use in discerning mRNA localization patterns within the *B. burgdorferi* bacterial transcriptome in order to characterize the infectious

chemical agent which, in conjunction with the human immunopathological response, is responsible for Lyme disease morbidity. In this procedure, I conjugate NHS-ester modified amino-labeled nucleotides to tag a novel fluorescent dye to antisense DNA which, upon introduction into *B. burgdorferi* cytoplasm via fluorescence in situ hybridization, complexes with complimentary mRNA sequences. Visualization is performed using confocal and stimulated emission depletion microscopy.

**Brielle Antonelli '18**

***Role of AMPA Glutamate Receptors in the Hypoxic Ventilatory Response (HVR) of Hyperoxia-reared Neonatal Rats***

**Ryan Bavis, Biology, advisor**

The ventilatory response to low oxygen conditions (hypoxia) in newborn mammals is biphasic and becomes more sustained with maturation. Neonatal rats reared in high oxygen (hyperoxia) have a sustained response earlier in development, and AMPA glutamate receptors may contribute to this sustained HVR. To test this, hyperoxia-reared (60% O<sub>2</sub>) rat pups and control (21% O<sub>2</sub>) pups received the AMPA glutamate receptor antagonist drug, NBQX, or saline prior to measuring their HVR. If AMPA receptors contribute to their sustained HVR, hyperoxia-reared rats treated with the drug will have a biphasic HVR similar to the control group during acute hypoxic challenge.

**Mansib Tahsin Arko '21**

***Rohingya Exodus: The Impact on Bangladesh***

**Carla Abdo-Katsipis, Politics, advisor**

The latest Rohingya exodus saw about 1 million Rohingyas entering Bangladesh, which is grappling with the changing demographic in its southern region. The mounting refugee population has naturally led to competition with the locals for scarce resources (food, jobs, land) around the refugee camps. This poster presentation is concerned with the dynamic in race relations between these two groups. Rohingyas don't have access to citizenship and have to be, for most part, confined to the camps, but the extensive presence of the group over a large area has resulted in many instances of Bangladeshis losing land, fishing access, and education. And as long as the current approach to relocating the Rohingyas remains unfruitful, it's important to address issues of race relations to ensure that increasing tensions do not force the Rohingyas to be displaced again.

**Emily Bacon '18**

***mRNA Decay in Borrelia burgdorferi***

**Paula Schlax, Chemistry and Biochemistry, advisor**

The bacterium *Borrelia burgdorferi* is a spirochete that cycles between tick and vertebrate hosts, infecting them with Lyme disease. Gene expression of key virulence factors is regulated in *B. burgdorferi* as a response to changes in environmental stimuli as the bacterium changes hosts. The importance of gene regulation in the enzootic

cycle is well established; however mRNA degradation pathways are not well characterized. In this study, the time-dependent decay of mRNA transcripts encoding for specific virulence factors was studied. Preliminary results suggest that the mRNA transcripts encoding for these key virulence factors may be differentially degraded in different osmotic environments.

**Marissa Bale '19 – see Adair Andre '18**

***Sustainability Initiatives at Bates*** ♻️

**Jane Costlow, Environmental Studies, advisor**

**Michael Bancroft '18**

***Experiments with the Equatorial Beta Plane***

**Jeffrey Oishi, Physics and Astronomy, advisor**

The goal of this research is to study the problems that arise due to the mathematical formula used/required when studying geophysical behavior along and near the equator. Error can result because the formula for the Coriolis force has a sine term contained within it, which returns a zero when applied to behavior running parallel to the equator. In order to account for this, we use the equatorial beta plane, which is an approximation for Coriolis force. This research is a continuation of the thesis work of Charles Colony '17. We have taken these same equations and use an initial value problem approach to solve the differential equations. We also are including a magnetic field in the simulations and observing how varying strengths of magnetic fields affect the propagation of waves in the tachocline layer of the sun.

**Lindsey Beauregard '18**

***"Zonal" Molecular Organization of Olfactory Bulb***

***Mitral Cell Layer Based on Gene Expression***

**Jason Castro, Neuroscience, advisor**

This thesis takes a data-driven approach to investigate whether the mitral cell layer of the olfactory bulb is differentiated in terms of gene expression. Zonal molecular organization could suggest that these principal projection neurons have specialized roles, implying that the bulb is not one uniform circuit. By analyzing the densely cataloged, whole-genome expression maps of the Allen Brain Atlas, this study should produce highly representative data about gene contribution to regional heterogeneity, demarcation of distinct subregions, and modularity of organization and function within the olfactory processing stream.

**Hannah Behringer '18**

***Assessing the Efficacy of a Chronic Disease Self-Management Program (CDSMP)***

**Karen Palin, Biology, advisor**

Seniors Plus, an aging and disability resource center in Lewiston, offers self-management programs for individuals with chronic diseases. While Seniors Plus has collected some feedback about the classes, there has been no comprehensive formal analysis of how the program affects

participants. For my senior thesis, I am collecting and analyzing participant data through surveys administered prior to and after completion of a CDSMP. Individuals are asked to rate their confidence with managing the disease and about their utilization of healthcare. This information will be used in further support of program funding and the expansion of these workshops.

**Brooke Benedict '18 and Christpher Lietz '18**

***Comparative Analysis of Chiral Solvating Agents for NMR Enantiomeric Differentiation of Amines***

**Thomas Wenzel, Chemistry and Biochemistry, advisor**

Acidic chiral solvating agents (CSAs) were used to protonate primary, secondary, and tertiary chiral amines to determine the preferred CSA for the purpose of analyzing enantiomeric excess. Eleven CSAs were used with 24 amines, providing broad coverage for a variety of applications. Early results suggest (R)-(-)-O-acetylmandelic acid, N-(3,5-dinitrobenzoyl)-(R)-(-)- $\alpha$ -phenylglycine, (S)-2-methoxy-2-(1-naphthyl)propionic acid, (S)-(+)-mandelic acid, and (R)-(-)-1,1'-binaphthyl-2,2'-diylhydrogenphosphate may be appropriate for baseline differentiation of the three broad classes of amines tested. Current work will extend our analysis to cover more resonances of the amines.

**Ethan Benevides '18**

***Effects of Shipping Stress on Carotid Body Responses in Newborn Rats***

**Ryan Bavis, Biology, advisor**

It is common for researchers studying newborn rats to have pregnant rats shipped to them from commercial suppliers. The purpose of this study was to determine the effects of shipping stress on carotid body responses to hypoxia. Carotid body-petrosal ganglion complexes were harvested on postnatal day (P)4-5 or P10-12 from rats shipped to the Bates College Animal Colony in utero on embryonic day (E)13, E17 and E19 or rats bred in house. Single-unit chemoafferent activity was recorded from petrosal ganglion cells during a two minute baseline period in which carotid body-petrosal ganglion complexes were exposed to 21% O<sub>2</sub>/5% CO<sub>2</sub> and a two-minute hypoxic period at 5% O<sub>2</sub>/5% CO<sub>2</sub>. All groups showed a similar amount of baseline activity and peak activity in response to hypoxic exposure, therefore shipping stress had no effect on carotid body responses to hypoxia.

**Gabe Benson '20**

***Potential Information on Reward Offered by *Lyonia ligustrina* Flowers***

**Carla Essenberg, Biology, advisor**

This study examined the possibility that the diameter of flowers native to Maine, *Lyonia ligustrina*, provides information about the amount of reward the flower produces for its pollinators. Greater flower diameter in *Lyonia* was positively correlated with greater amounts of

nectar sugar. Flower diameter indicated information both on how much sugar different plants offered in relation to each other, and on the amount of sugar offered by different flowers within the same plant. Flower diameter and pollen production were not significantly related to each other. Future work will explore fitness consequences to *Lyonia ligustrina* of providing information about reward production.

**Rebecca Berger '19**

***Stage Managing Diary of a Madman***

**Katalin Vecsey, Theater, advisor**

*Diary of a Madman*, a one-man play adapted from Gogol's 1835 short story and performed by Nathaniel Stephenson '18, was no small feat. With over 1,000 light, sound, and visual cues in the 50-minute show, the experience of stage managing was quite challenging. To manage 11 performances on campus and take the whole show on the road to participate in the Kennedy Center American College Theater Festival in Connecticut, I developed a stage manager prompt book which detailed every aspect of the production. This was my ultimate guide to everything *Madman*.

**Allison Berman '18**

***Using Shortridge Effectively to Benefit the Phippsburg Community: A Look at Experiential Outdoor Educational Models and a Proposal for a Summer Camp***

**William Wallace, Education, advisor**

Bates' Shortridge Coastal Center is a Bates-owned property in Phippsburg, ME, that is used mainly by Bates students and researchers. After working at Shortridge for a course, I noticed the potential for the property to act as an outdoor classroom for the Phippsburg community. In this thesis, I will look at different models for outdoor, adventure, and experiential education and also the benefits of these types of experiences in order to come up with a proposal for a summer camp that furthers the science learning goals of Phippsburg Elementary School and helps to build the connection between Phippsburg and Bates College.

**R. J. Bingham '18**

***Gray Matter: Short Stories about Race and Growing Up -- A Look into My Senior Creative Writing Thesis***

**Jessica Anthony, English, advisor**

Some things aren't always just black and white, there's a grayness that holds endless stories and tales meant to muddy the waters between black, and white. My thesis is a collection of short stories told from a semi-autobiographical position of fiction. As someone who's walked the line between black and white all my life, I hope both to clarify and complicate the conversations about race here at Bates and beyond.

**Katherine Blandford '18*****Kate and Käthe: (Mis)Adventures in Graphic Novel Form*****Jessica Anthony, English, advisor**

In this presentation, I discuss my graphic novel thesis about the origins of female fear, my own difficulty speaking and the life-changing experience of researching another woman's life intimately. Käthe Kollwitz (1867 - 1945), a German Expressionist artist, feminist, and pacifist, is the subject of one thread in my novel, while my research (and introspection) process constitutes the other.

**Rachel Blaustein '18*****Investigation of Zebrafish *alas2* Gene and Its Role in Hypochromia Seen in *Nfe2* Knockout Embryos*****Larissa Williams, Biology, advisor**

This thesis project sought to solidify evidence of transcription factor Nfe2's cis-regulatory control of heme biosynthesis gene *alas2* in developing zebrafish. A previous study done by Dr. Larissa Williams showed that embryos lacking the Nfe2 gene had a downregulation of *alas2* expression and displayed hypochromia. To connect these two observations, a gain of function assay will be performed in Nfe2 knockout embryos. By injecting capped mRNA coding for the *alas2* gene, we can assess whether a normal blood phenotype can be rescued in affected fish. Partial regain of healthy hemoglobin formation will point more clearly towards the downregulation of *alas2* in the zebrafish as the cause of their hypochromia.

**Jason Boisvert '18*****Role of *Nfe2* and Related Factors in Mitigating Phthalate Toxicity*****Larissa Williams, Biology, advisor**

Phthalates are common plasticizers used to manufacture flexible plastics, such as those used in medical tubing. MEHP and other phthalates are known peroxisome proliferators, meaning they are known to induce oxidative stress. Nfe2 and related transcription factors regulate pathways involved in the oxidative stress response, and thus may play a role in mitigating developmental toxicity of MEHP and other phthalates. To investigate this role, we used morpholino knockdown to reduce levels of Nfe2 and related factors in developing zebrafish embryos, and recorded any resultant changes in oxidative stress response pathways and incidence of aberrant developmental morphologies.

**Andrea Boitnott '18*****Tet1 Mediated Hypermethylation of DNA Enhances Learning and Memory in a Mouse Model of Pitt-Hopkins Syndrome*****Andrew Kennedy, Chemistry and Biochemistry, advisor**

DNA methylation in the adult central nervous system is necessary for cognitive processes, such as learning and memory. In this study, we tested the idea that increasing the longevity of DNA methyl marks encoded onto the genome

after experiential learning will increase the strength and fidelity of that memory. We found that cytosine hypermethylation improves and restores aspects of hippocampal-dependent spatial learning and memory, as well as memory retrieval, in mice with an ultra-rare autism spectrum-like disorder known as Pitt-Hopkins Syndrome (PTHS). This suggests that DNA methylation may be a useful therapeutic target for PTHS and other monogenetic intellectual disabilities.

**Kate Bouchard '18*****Love, Lemon*****Jessica Anthony, English, advisor**

*Love, Lemon* is a story about a young girl, Lemon Green, who makes plenty of mistakes. Lemon must learn how to navigate these mistakes in order to escape the surreal world that has been built out of the part of Lemon's imagination that is used for the bad. *Love, Lemon* is a story about the power of imagination, words, and growth. *Love, Lemon* contains illustrations done in ink and watercolor that capture and further explain the real and alternate worlds of Lemon Green.

**Katherine Bower '18*****Behavioral Strategies for Mechanical Removal of Bacteria from the wings of *Bombus impatiens* Bumblebees*****Andrew Mountcastle, Biology, advisor**

Both insects and bacteria are among the most numerous organisms on our planet, and they share a long evolutionary history of interactions. Although much work has focused on understanding how insects serve as vectors for human disease transmission, we know relatively less about the various strategies through which insects protect themselves from harmful bacterial establishment. These strategies include both chemical, structural, and mechanical defenses. In this study, we explored the extent to which bumblebee behaviors reduced bacterial counts on their wing surfaces via mechanical dislodgment.

**Chris Bradna '20 and Fahim Sakil Khan '20*****Automatic Selection of Galaxies with Signatures of Extraplanar Gas in the MaNGA Survey*****Aleksander Diamond-Stanic, Physics and Astronomy, advisor**

In pursuit of answers to the question, why are some galaxies inefficient at forming stars?, this research focuses on creating automated methods of identification of galaxies with signatures of extraplanar ionized gas. We analyze galaxies available as of November 2017 in the Mapping Nearby Galaxies at Apache Point Observatory (MaNGA) survey. Some galaxies cannot collapse cold gas to form stars and the reasons why some galaxies become inefficient at forming stars are not yet known. We hope that the study of extraplanar ionized gas will contribute to the general understanding of the evolution of galaxies and the

processes influencing star formation. Using code released by the data analysis pipeline, we programmed an algorithm that analyses each galaxy in the fifth version of MaNGA Product Launch (MLP-5) and returns galaxies that exhibit characteristics that suggest the presence of ionized extraplanar gas. We analyze the effectiveness of this algorithm and put the results in a broader perspective for the analysis of galaxies that contain extraplanar gas.

**Alanis Carmona '18**

***Obesity Resistance via the Deletion of Laminin alpha-4 through Upregulation of UCP-1***

**Larissa Williams, Biology, advisor**

This study explored a series of genes obtained from an unbiased RNA-Sequence experiment indicating that the deletion of laminin alpha-4 in vivo leads to obesity resistance through the upregulation of mitochondrial uncoupling protein (UCP1). RT-PCR was used to verify results obtained from an RNA-Sequence experiment to look for gene expression changes between wild-type and mutant mice as a means of deriving a mechanism to explain the observed obesity resistance. Statistically significant differences were seen in the three particular genes, DIO2 in a chow diet and ESRRB and ADRB3 on a high fat diet (HFD). It is likely that laminin alpha-4 deficiency led to the up regulation of these genes which, in turn, may be responsible for the increase UCP1 expression seen in these mice.

**Dylan Carson '18, Raye Chappell '18, Anna Franceschetti '18, Samantha Grant '18, Jane Hodell '18, Brigid Quinn '18, and Hannah Singer '18**

***Contemporary Social Issues: Sociological Perspectives***

**Emily Kane, Heidi Taylor, and Michael Rocque, Sociology, advisors**

In this panel, sociology thesis researchers address a variety of contemporary social issues: drug use and addiction, language, social media, and campus-community relations. These issues and more are explored in the context of their connections to key social institutions including education, law, public policy, and inequalities of race, class, and gender.

**Anabel Carter '18**

***Mapping the Distribution of Resilin in the Wings of Bees and Wasps***

**Andrew Mountcastle, Biology, advisor**

Resilin, a rubber-like protein, appears in the wings of many insects. Recent work has begun to reveal the important functional roles of particular resilin joints. However, little is known about the distribution of resilin in the wings of bees and wasps, and the extent to which it varies across the hymenopteran phylogeny. We used confocal microscopy to map the distribution of resilin and found that the overall number, positions, and shapes of resilin structures varied

widely across hymenopteran families. Our results raise important questions surrounding the evolutionary and functional implications of diverse wing morphologies.

**Hazel Cashman '18**

***The Postglacial Riverton Stage of Glacial Lake Israel: Important for the Occupants of the Israel River Complex?***

**J. Dykstra Eusden, Geology, advisor**

This project, funded by a Bates Student Research Fund grant, was undertaken in fulfillment of a combined senior thesis in geology and anthropology. Conducted in the Israel River Valley near Jefferson, NH, the study focuses on the period just after the deglaciation of New Hampshire, from about 15,000-10,000 years ago. The study aims to determine the relationship of a collection of archaeological sites (termed the Israel River Complex) to the changing postglacial environment of the valley, where a glacial lake (Glacial Lake Israel) drained incrementally and created an environment suitable for early human occupation and caribou hunting.

**Sally Ceesay '18**

***Hypoxic Ventilatory Response and Acclimatization***

**Ryan Bavis, Biology, advisor**

The presence of oxygen is fundamental to survival. Its balance in demand and utilization is critical in maintaining homeostasis within the body. Hypoxia is characterized by a decreased partial pressure of oxygen (PaO<sub>2</sub>) in the environment. Prolonged exposure to hypoxic environments results in an increase in ventilation at all inspired levels of O<sub>2</sub>, known as ventilatory acclimatization to hypoxia. In this study, adult male rats were chronically exposed to hypoxia (10% O<sub>2</sub>). They were found to have a higher ventilation when exposed to room air (21% O<sub>2</sub>). And when exposed to a hypoxic environment (12% and 10% O<sub>2</sub>), the chronically hypoxic rats were shown to have a lower ventilation than the control rats. These data are not consistent with what previous studies have shown and we hypothesize that this maybe either be due to the methods used to produce a hypoxic environment or the different strain of rats used.

**Raye Chappell '18 – see Dylan Carson '18**

***Contemporary Social Issues: Sociological Perspectives***

**Heidi Taylor, Sociology, advisor**

**Keila Ching '19, Sofia Elbadawi '18, and**

**Riley Hopkins '18**

***Performance, Choreography, and Collaboration: The Dance Research Process***

**Rachel Boggia, Dance, advisor**

In this panel discussion featuring Bates senior Dance majors, each student will briefly describe their own individual thesis research methods. These theses explore topics ranging from somatic practices as a mode of liberation for marginalized groups, to embodying a specific

work from the Trisha Brown Dance Company, to a choreographic exploration of love songs and metaphors for love.

**Maria-Anna Chrysovergi '18**

***Population Genetics of the Bloodworm, *Glycera dibranchiata*, in the Gulf of Maine***

**Larissa Williams, Biology, advisor**

The bloodworm *Glycera dibranchiata* is one of the most popular polychaeta species used as saltwater bait. Harvested from mud flats in Maine and Canada, it supports a huge fishery industry worth more than \$11.5 million combined annually. Knowledge about the abundance and genetic history of this species is limited and as a result regulations about its harvest and control are few and not sustainable. Goal of our study is the understanding of the population genetics of *Glycera dibranchiata* around different mud flats in the Gulf of Maine that will lead to a more efficient control of this species.

**Anh Chu '18**

***Mother Blaming? Representation of Mothers in *Kokuhaku* (2010)***

**Keiko Konoeda, Japanese, advisor**

This research investigates the representation of mothers in the Japanese movie *Kokuhaku* (*Confessions*) directed by Nakashima Tetsuya. As the story revolves around a grieving mother that sought revenge against two middle-school students who were responsible for her daughter's death, three distinct mothers play a fundamental role. My research focuses on the connection of these three characters among themselves and between other key characters in the film. More importantly, I look into whether these mothers are blamed for the all their children's wrong-doings and misfortunes in the story for simply not being the "perfect mothers."

**Gabriella Chua '18 – see Joseph Alp '18**

***Designing TET Enzyme Inhibitors to Enhance Learning and Memory***

**Andrew Kennedy, Chemistry and Biochemistry, advisor**

**Raegine Clouden Mallett '18**

***Translation Efficiency of *flaB* from *Borrelia burgdorferi*: Effects of Change in Secondary Structure of mRNA Leader Region***

**Paula Schlax, Chemistry and Biochemistry, advisor**

An experimental approach, based on bioinformatics analysis to determine the role of the secondary structure of the *Borrelia burgdorferi* *flaB* 5' UTR on translational efficiency and RNA decay rates are presented. Predictions of the folding of sequence variants expected to alter translational efficiency and RNA decay rates and summary of the experimental approach are described. Both the production of the FlaB structural protein and the regulatory role of the CsrBb protein are important for the enzootic

cycle of *B. burgdorferi*. This study can provide information of the sensitive regulatory mechanisms that take place during the transfer of the bacteria from tick host to vertebrate host.

**Peter Cottingham '18**

***Role of the GABAA and GABAB Receptors in the Hypoxic Ventilatory Response of Neonatal Rats***

**Ryan Bavis, Biology, advisor**

Previous research done in anesthetized newborn piglets indicate that the decline in ventilation experienced in the second phase of the biphasic hypoxic ventilatory response (HVR) is due in part to  $\gamma$ -aminobutyric acid (GABA) signaling through GABAA and GABAB receptors (Huang et al. *J Appl Physiol* 77:1006-1010, 1994). In order to establish if a similar relationship exists in newborn rats, we measured ventilation at both normal oxygen levels and in hypoxia utilizing head-body plethysmography after administration of either a GABAA or GABAB receptor antagonist. Our results indicate that the decline in ventilation of the biphasic HVR is not regulated by GABAergic signaling in newborn rats.

**Students in DN/MU 337, Atelier**

***Coherence, Hermeneutics, and World-Entering in So-called New Media: Please Come Listen to Us***

**William Matthews, Music, advisor**

Questions of phenomenology generate when we sit down to figure out how to make meaningful art that incorporates and occupies the various "spaces" or "disciplines" of video, dance, music, written and spoken word, and computer code. And other things. On what ground do combined modes stand? How can we create a framework for coherence of all permutations of these modes without restricting impact and evaluation to determination of creator intent? Or are we just augmenting one expressive mode with others? Students of DN/MU 337, Atelier, will present their findings.

**Hanna De Bruyn '18**

***Does Scene Category Information Persist after Backwards Masking?***

**Michelle Greene, Neuroscience, advisor**

Backwards masking introduces a visual stimulus (mask) to the retina directly after presenting the initial stimulus (target) is presented, thus preventing memory from processing the target. We still do not understand to what extent the target is processed during the masking period. This experiment investigated the degree to which target information was processed during the masking period using EEG along with multivariate pattern analysis via a support vector machine. Lastly, a sliding window was used to investigate time-resolved information to understand what target information leaked into the masking period.

**John Dello Russo '18**

*Establishing the Thermoneutral Zone of Neonatal Sprague-Dawley Rats*

**Ryan Bavis, Biology, advisor**

A mammal's thermoneutral zone (TNZ) is the range of ambient temperatures in which their minimal metabolic rate is capable of maintaining a constant body temperature. The first objective was to establish the TNZ of neonatal Sprague-Dawley rats at ages that are often studied. It was also important to determine whether or not the conventional means of evaluating TNZ are sufficient enough to deliver reliable data. The underlying purpose of this study is to determine the lowest temperature within the neonatal rat's TNZ, which can, then, be utilized in future studies to ensure more accurate measurements of metabolism and, therefore, breathing.

**Kwamae Delva '18**

*Analysis of High Velocity Outflows in 14 Compact Starburst Galaxies with Absorption-Line Spectroscopy at High Spectral Resolution*

**Aleksander Diamond-Stanic, Physics and Astronomy, advisor**

This research is an analysis of the absorption spectra of 14 compact starburst galaxies of redshift  $z = 0.4-0.8$  that exhibit outflows  $> 1000$  km/s with the 10-meter Keck telescope and HIRES spectrograph. These data allow us to examine the velocity structure of outflowing gas as traced by blueshifted interstellar absorption lines- specifically for various various Mg and Fe ions. Furthermore, the estimated values for optical depth ( $\tau$ ) and covering fraction to help coax more information about each galaxy. Plotting these characteristics versus velocity often exhibited the complex nature of our data, and the need to update the voigt profile technique currently being used to model the complex velocity structure of each galaxy. This paper focuses on integrating a Python package, called linetools, to handle the complex velocity structure of our galaxies, but a code that generates covering fraction plots and bring Fe ions into the loop was also developed. This will allow for the exploration of how the Mg/Fe ratio varies as a function of velocity, which will provide information about the chemical composition and age of each galaxy. In the future the linetools code will be used to accurately model complex velocity structures, allowing for deep and accurate connections to form between my sample of galaxies. This will also lead to the creation of comparisons between the data and that of more typical galaxies to create a classification system for the "life cycle" of a broad range of galaxies.

**Allison Dewey '18**

*Perceptions of Helping Behaviors at Bates College*

**Susan Langdon, Psychology, advisor**

In this study, we investigated the perceptions of helping behaviors throughout the Bates community and how they are influenced by bystander intervention training or not. Participants were asked to answer an array of questions on bystander behaviors and campus norms in regards to power-based personal violence. The online survey questions aimed to establish a baseline of what Bates students do and do not do and dosage effects of Green Dot and other forms of bystander intervention training. We hope this will inform future efforts of education and prevention of sexual violence on campus.

**Emily Disler '18**

*The Imaging of RNA Localization in E. coli and Borrelia burgdorferi Cells*

**Paula Schlax, Chemistry and Biochemistry, advisor**

Fluorescent-labeled oligonucleotides were used to target three sRNAs, OxyS, RyhB, and GlmZ, in *E. coli* cells to enable the observation of RNA localization. A greater understanding of RNA localization will provide insight into mechanisms underlying RNA synthesis, function, and degradation. RNA Fluorescent in-situ Hybridization (FISH) was performed to observe the localization of sRNAs. The cells were visualized using a confocal microscope and STED (stimulated emission-depleted) microscope. Once we better understand RNA localization in *E. coli*, we will perform the same protocol in *Borrelia burgdorferi* cells, the bacteria that causes Lyme disease, to provide insight into the mechanisms underlying Lyme disease.

**Victoria Dobbin '18 and Julia Nemy '18**

*An Image of Local Francophonie: Djiboutian Experiences in Lewiston and Cultural Transmission at Lewiston High School*

**Alexandre Dauge-Roth, French and Francophone Studies, advisor**

Nemy's and Dobbin's documentaries present two views of Francophone immigrant life in Lewiston. While distinct in their focus, the films feature interviews and conversations with local Francophone community members, both established residents and recent arrivals. Dobbin investigates cultural transmission and exploration at play when learning French. She focuses on three Lewiston High School parent groups: Anglophone parents, Franco-American/French Canadian parents, and French-speaking African immigrant parents whose children are taking French classes in Lewiston public schools. Nemy's project focuses on Djiboutian immigrants' transitions in the United States. In particular, she explores the challenges in adapting to life in Lewiston and what resources have been the most useful during this period of change.

**Jade Donaldson '18**

***Agging Pains: Perspectives on the Relationship between Agging and Pain in Older Adults in the State of Maine***  
**Elizabeth Eames, Anthropology, advisor**

In the United States, individuals aged 65 and older are given the label "senior," a classification that carries implications of dependency and decline. These implications can lead to the interpretation of pain in an older person as a sign of aging rather than illness. This project aims to address the normalization of pain in older adults in Maine from the perspective of 1) geriatric care providers, 2) state organizations that provide support for the aging, and 3) older adults themselves, and speaks how the meaning of pain is created, interpreted, expressed, and negotiated with respect to age and aging.

**John Doyle '18**

***Eelgrass Carbon Storage in the Gulf of Maine***  
**Beverly Johnson, Geology, advisor**

*Zostera marina*, commonly called eelgrass, is a tidal angiosperm that is found throughout the Gulf of Maine. Eelgrass beds provide a number of ecosystem services such as coastal buffering, filtering metals, and sequestering carbon. Sequestering in Maine has not been studied. Cores were taken concentrating on the Casco Bay region and were analyzed to discover that eelgrass beds contain about 13 kg of carbon per cubic meter. Extrapolated across eelgrass beds in Casco Bay, that amounts to  $5.4 \times 10^{-8}$  kg of carbon, the same as burning  $2.3 \times 10^{-8}$  gallons of gasoline. This study demonstrates that eelgrass in Maine is an effective carbon sink.

**Christopher Dsida '18**

***Glomerular Analysis in the Human Olfactory Bulb***  
**Travis Gould, Physics and Astronomy, advisor**

Building on techniques developed to analyze olfactory bulb development in mice, we examine glomerular structure in samples from the human brain. Three-dimensional datasets obtained with lightsheet microscopy are processed using MATLAB, then segmented to construct a model from these images. This model is then used for volumetric calculations of glomeruli as well as understanding their distribution in the bulb.

**Zsofia Duarte '18, Danielle Fournier '18, Dylan Franks '18, Emily Halford '18, Sophie Moss-Slavin '18, Allegra Sacco '18, Keenan Shields '18, Joe Tulip '18**  
***Research and the Public Good: Multi-disciplinary Explorations***

**Darby Ray and Sam Boss, Harvard Center for Community Partnerships, advisors**

How can undergraduate research contribute to community well-being and social justice? This year's Community-Engaged Research Fellows hail from diverse disciplines, but they share an interest in the public purposes of higher education and the potential of research to address

community needs. This interactive session features community-engaged projects targeting a range of issues and developed in collaboration with diverse community partners. Please see the program for each fellow's talk title.

**Jessica Duserick '18**

***Urban-Woodland Gardening as a Mechanism for Sustainable Landscaping and Future Recommendations for the Bates College Campus***

**Carla Essenberg, Biology**

The scientific field of urban ecology is relatively new with respect to the history of biological thought. This niche field of biology explores the ways in which urban environments can conserve the presence of native wildlife. I review the literature on different factors that contribute to the conservation of wildlife species, like birds and insects, in urban environments. A large portion of this literature emphasizes the quality and quantity of vegetation presence as the predominating factor for conserving biodiversity in urban landscapes. In reviewing the ecological literature on the quality of native vs. exotic vegetation, I argue that conserving native vegetation in New England still has pressing importance. Urbanization has significantly reduced the presence of native tree and herb species in the region throughout the 20th and 21st centuries. Spaces like the Bates College campus specifically could play a role in regenerating New England's native plant life within urban surroundings, with implications for creating habitat for native wildlife. Future use of native plants in the landscaping regime of the Bates campus would provide a mechanism for sustainable landscaping. Native plant gardens on-campus could also generate a greater community awareness of naturalistic landscaping as a mode of best-practice in urban environments.

**Elizabeth Eareckson '21 – see Adair Andre '18**  
***Sustainability Initiatives at Bates*** 

**Jane Costlow, Environmental Studies, advisor**

**Students in EDUC 450, Seminar in Educational Studies**  
***Community-Based Research in Educational Studies***

**Patricia Buck, Education, advisor**

As a capstone experience during their senior year, Educational Studies minors participate in a group community-based research project. In the fall of 2017, seniors engaged in one of two projects. The first group partnered with Tree Street Youth, a local community organization, to conduct a series of focus groups aimed at gathering the perspectives of youth of color on patterns of racial disproportionality in exclusionary discipline. In this session, student researchers present the results of their study and reflect upon their implications in light of the district's efforts to institutionalize restorative practices. Youth perspectives offer new insight into the perceived nature of discrimination and suggest tangible and empowering approaches to reducing inequality. The second

group of seniors examined the implementation of literature circles in an English Language Learning classroom at Lewiston High School. Their findings highlight the particularized resonances of various types of culturally relevant texts as well as how the application of literature circles affects student comprehension and confidence, English language proficiency, and engagement in discussions about difference and power. Researchers find that to ensure student success, teachers should adapt literature circles and culturally relevant material to reflect unique classroom environments and background experiences of student populations.

**Sofia Elbadawi '18 – see Keila Ching '19**

*Performance, Choreography, and Collaboration: The Dance Research Process*

**Rachel Boggia, Dance, advisor**

**Students in ENVR 308, Urban and Regional Food Systems**

*Evaluating Gleaning as a Strategy for Addressing Food Waste and Food Insecurity in Androscoggin County* ♻️

**Francis Eanes, Environmental Studies, advisor**

Roughly 30-40% of food grown in Maine never gets eaten, while at the same time one in six Mainers lacks consistent access to affordable, nutritious, and culturally appropriate food. Gleaning – a coordinated effort to divert locally grown food that would otherwise go to waste into the distribution stream of food banks and other emergency food providers – continues to garner interest as a means for simultaneously combating the twin problems of food waste and food insecurity. Food system practitioners in Lewiston and Auburn have recently begun the process of establishing a volunteer-run gleaning network in Androscoggin County, and partnered with students in Environmental Studies 308, Urban and Regional Food Systems, to conduct background research to support the network. This panel presents and discusses findings from this semester-long partnership, with particular emphasis on the constraints and opportunities that food banks face with respect to receiving and distributing locally gleaned food.

**Woods Fairchild '18**

*Examining Authentic Movement Conscious Dance as a Method for Increasing Mental Well-being among College Students*

**Alex Borgella, Psychology, advisor**

Authentic movement conscious dance is a widely applicable, accessible, and non-pathologizing wellness practice just beginning to make its way onto college campuses. Authentic movement, the engagement in free-form exploratory movement, is supported by empirical evidence suggesting its unique ability to decrease negative symptoms among individuals with mental illnesses, post-traumatic stress, and drug/alcohol addictions. This research summarizes previous findings in both biochemical and self-

reported fields of evidence. This research intends to educate young adults about this lesser-known wellness resource and offers an action proposal for jumpstarting efforts to make authentic movement classes a regularly offered wellness programming on college campuses.

**Becca Ferguson '18**

*Understanding Youth Contributions to Indigenous Sovereignty and Climate Justice through an Analysis of the #noDAPL Movement*

**Joseph Hall, History, advisor**

This yearlong environmental studies thesis analyzes how decolonization and resurgence actions involving youth activism and leadership are important to the persistence of Indigenous communities in the United States. I use the #noDAPL movement as a case study and argue the way that Indigenous youth are mobilizing community organizations to reclaim control of land reverses established colonial relations and revives struggling communities. Additionally, Indigenous youth are leading the conversations and structure of decolonization and resurgence into a new framework that links climate justice and Indigenous sovereignty.

**Michael Florentino '18**

*A Mortal God: How Augustus Motivated, Maneuvered, and Molded a Disunited Republic into an Empire*

**Hamish Cameron, Classical and Medieval Studies, advisor**

Religion, whether as an agent of stability or frailty, of progress or stagnation, or simply a harbinger of change, has long existed as a critical factor in life around the world. Under a republic and an empire, religion was an essential facet of Roman personality, ingrained from early age and, therefore, familiar to all. After decades of civil war, Gaius Octavius, or Augustus, needed to stabilize Rome and his position of power, lest he suffer the fate of his late adoptive-father, Julius Caesar. He spread his word through various forms of media such as architecture, literature, and, most interestingly, religion, through which Augustan propaganda was at its most brilliant and effective because it allowed the would-be emperor to touch all levels of society, catapulting himself to the highest echelons of Roman society.

**Danielle Fournier '18 – see Zsofia Duarte '18**

*Research and the Public Good: Multi-disciplinary Explorations*

**Darby Ray, Harvard Center for Community Partnerships, advisor**

**Anna Franceschetti '18 – see Dylan Carson '18**

*Contemporary Social Issues: Sociological Perspectives*

**Michael Rocque, Sociology, advisor**

**Dylan Franks '18 – see Zsofia Duarte '18**  
*Research and the Public Good: Multi-disciplinary Explorations*  
**Darby Ray, Harvard Center for Community Partnerships, advisor**

**Nate Frederick '19**  
*RNA Aptamer Synthesis Targeting Tissue Plasminogen Activator*

**Paula Schlabach, Chemistry and Biochemistry, advisor**  
Tissue Plasminogen Activator (tPA) is a protein associated with endothelial fibrinolysis and is cited as a potential biomarker for colorectal cancers. Through a procedure known as selective evolution of ligands by exponential enrichment (SELEX), a sequence of RNA was isolated that tightly and specifically binds the tPA protein. This RNA strand was sequenced, and secondary structure analyzed to gain insight into its interaction with the protein. Since RNA aptamers are increasingly being developed as indicators and inhibitory drugs of proteins in several diseases, this research improves our understanding and ability to target tPA and other biomarker proteins.

**Jacob Freedman '18**  
*Avian Communication in Adverse Weather Conditions: Migration Strategies of North American Warblers*  
**Donald Dearborn, Biology, advisor**

Many North American songbirds complete grueling bi-annual migratory journeys to reach better sites for breeding or over-wintering. During migration, they often use flight calls, short, characteristic "chips," to communicate and maintain flock integrity. Much is known about increased calling during poor weather conditions, but it is unclear whether birds alter aspects of their calls (e.g., length and frequency) to improve sound propagation. Flight calls of Palm and Canada Warblers were examined during spring migration over three years to characterize migration timing, call density, and call alteration.

**Elizabeth French '18**  
*Portraying Harper Pitt in Angels in America: A Process*  
**Timothy Dugan, Theater, advisor**

Considered to be one of the most important artistic works of the 20th century, Tony Kushner's *Angels in America, Part One: Millennium Approaches*, is an emphatic plea to alter societal values on religion, politics, sexuality, and American identity. Set in the fractured atmosphere of 1980s New York City, Kushner explores postwar conservatism and its rejection of progressive principles, especially concerning the abandoned gay community during the HIV/AIDS epidemic. I construct the character of Harper Amaty Pitt through the application of various tools proposed in Michael Chekhov's *To The Actor* and Constantin Stanislavski's *An Actor Prepares*.

**Domi Fridinger '21**  
*ReHarvest and Bates Gleaners* ♻️  
**Francis Eanes, Environmental Studies, advisor**  
ReHarvest is a group of Bates students and faculty seeking to minimize food insecurity while also minimizing food waste in Maine. We seek to achieve this goal by maximizing the efficiency of Maine gleaned networks through the creation of an automated system that connects farmers to gleaners to Emergency Food Providers.

**Katharine Gaillard '19 – see Adair Andre '18**  
*Sustainability Initiatives at Bates* ♻️  
**Jane Costlow, Environmental Studies, advisor**

**Caroline Gettens '18**  
*Targeting TET2 to Enhance Cognition*  
**Andrew Kennedy, Chemistry and Biochemistry, advisor**  
Levels of DNA methylation in the hippocampus are regulated via the Ten-Eleven Translocase (TET) family of enzymes which oxidize and remove methyl marks at the five position of cytosine. In this study, we utilized a series of TET2 knockout mice (TET2 ASO and TET2 floxed mice) to determine the role that TET2 plays in the formation and storage/maintenance of new memories. A significant increase in performance in an object location memory task in TET2 KO mice compared to WT mice was observed. This suggests that the increased fidelity of methyl marks in the hippocampus in response to learning may increase the lifetime of the memory. This work furthers our understanding of the involvement of TET2 in memory formation and maintenance and will allow us to assess the potential of TET2 as a future therapeutic target for the treatment of diseases and disorders of memory such as Alzheimer's disease.

**Matt Glasgow '19**  
*Reliability of Impedance in Diagnosing Gastroesophageal Reflux Disease*  
**Heidi Taylor, Sociology, advisor**

The purpose of this study was to analyze the utility of on-medication impedance-pH testing (MII-pH) in diagnosing gastroesophageal reflux disease (GERD). A seven-year, retrospective chart review identified 71 patients who underwent MII-pH testing while on medication and had pH testing while off medications. Among those with GERD based on abnormal impedance (>47 reflux events), 69% had GERD confirmed by pH testing while off medications. When there were >73 reflux events with MII-pH while on medication, all patients (n=15) had diagnosable GERD. Patients with >73 reflux events during MII-pH on medications do not require repeat pH testing off medication. Despite this threshold, MII-pH testing does not reliably diagnose GERD.

**Emma Goff '18**

***Judicial Decision Making on the Supreme Court of the United States: A Case Study of Roe v. Wade***

**Stephen Engel, Politics, advisor**

My research examines judicial decision making at the U.S. Supreme Court. I applied the three models of judicial decision making – attitudinal, legal, and strategic – to a case study of *Roe v. Wade* (1973).

**Matthew Goldberg '18**

***Numerical Solutions to Partial Differential Equations***

**Katharine Ott, Mathematics, advisor**

Several numerical techniques for solving partial differential equations were explored in this study. In particular, three methods are discussed in detail: difference methods, finite element methods, and spectral methods. The errors and stabilities of each of these methods are compared and contrasted. Certain techniques are applied to real-world problems, which are simulated on computer software such as MATLAB.

**Matthew Golden '20**

***A's B4 Bates/LMS***

**Emily Kane, Sociology, advisor**

An independent course study was completed in the fall of 2017, "Role Models through Sport," which focused on the importance of mentors and the perceptions of athletes as role models. The study was paired with forging a mentorship program inspired by A's B4, a nonprofit from New Bedford, MA, which promotes achievement in academics, athletics, and the arts through mentorship programming. *A's B4 Bates/LMS* brings Bates students to Lewiston Middle School for lunch once a week to build relationships with Lewiston youth, give and gain access to new perspectives, and inspire new dreams.

**Samantha Grant '18 – see Dylan Carson '18**

***Contemporary Social Issues: Sociological Perspectives***

**Heidi Taylor, Sociology, advisor**

**Ali Greene '20**

***Assistant Directing and Dramaturgy for Angels in America***

**Timothy Dugan, Theater, advisor**

*Angels in America* is an epic play about the AIDS epidemic, Ronald Reagan, Mormonism, characters facing unendurable circumstances, and inevitable but necessary change. Throughout the semester, I researched the historical background of the play and developed a dramaturgical packet for the cast of the Bates production. I also attended every rehearsal to study the art of directing and its application to the play. This transformative show provided me with many opportunities to delve into the art of directing, which can arguably only be taught through observation and experience.

**Dacota Griffin '18**

***The Relationship between Substrate Characteristics and Japanese Knotweed Invasion along the Saco River, ME and NH***

**Holly Ewing, Environmental Studies, advisor**

Japanese knotweed (*Fallopia japonica*) is a devastating invasive plant to native vegetation. It invades and spreads via several mechanisms making it hard to control. Currently, little is known about Japanese knotweed invasion along river systems, how knotweed changes riparian habitat, and what characteristics make invasion more likely at a site. In summer 2017, I collected physical data and soil samples along the Saco River in Maine and New Hampshire with and without Japanese knotweed infestations. The samples were examined to see whether physical and chemical characteristics were similar among knotweed-invaded sites and the potential for knotweed invasion at other sites.

**Emily Halford '18 – see Zsafia Duarte '18**

***Research and the Public Good: Multi-disciplinary Explorations***

**Darby Ray, Harvard Center for Community Partnerships, advisor**

**Maddie Hallowell '20, Colby Marsh '21, Kenza Nadifi '21, Tommy Sheils '21, Charlie Stewart '21, Libby Wellington '20, and Hanning Grace Xu '21**  
***Choreography, Composition, and Code***

**Rachel Boggia, Dance; Matthew Jadud, Digital and Computational Studies; and William Matthews, Music, advisors**

Students in DANC 351, Advanced Composition Seminar; MUS 237, Computers, Music, and the Arts; and DCS 102, Design of Computational Systems, spent the winter semester collaborating as choreographers, composers, and computationalists to develop performances that deeply integrate dance, music, and computing. Their work is as creative as it is challenging, and this session will include performances of their compositions as well as opportunity to experiment with the technologies involved.

**Katue Hartnett '18**

***To What Extent Does Prior Experience Influence Visual Perception?***

**Michelle Greene, Neuroscience, advisor**

Human observers have the capability to describe and categorize complex scenes upon seeing them for just fractions of a second. However, this capacity is diminished when scenes are less predictable (Greene et al., 2015). Examining steady state visually evoked potentials (ssVEP) provides an objective measure of whether these deficits are due to semantic misunderstanding of less predictable images, or if they are due to an impaired ability to perceive

these images. Our findings will help bring vision science toward a more complete understanding of the neural mechanisms behind visual perception.

**Erin Hazlett-Norman '19**

***Cosmovision in Resistance: Cultural Values, Food Sovereignty, and One Andean Indigenous Community's Struggle for Autonomy and Collective Resilience in the Face of Neocolonialism and Climate Change***

**Jane Costlow, Environmental Studies, advisor**

In times of ever-increasing globalization, neocolonialism threatens the rights and self-determination of indigenous peoples worldwide while climate change puts many traditional agricultural practices at risk. A Quechua agrarian collective in the Peruvian Andes known as the Parque de la Papa resists and mitigates the challenges its constituent communities face through practices of food sovereignty based in core values of the Andean cosmovision. This presentation is based on research conducted in the community of Paru Paru in the Parque de la Papa. It examines four specific Andean cultural values, analyzing their role in the community's strategies of decolonization and agro-ecological resilience.

**Madelyn Heart '18**

***Projected Risks of Climate Change on Disease Vectors and Human Health in New England***

**Karen Palin, Biology, advisor**

This project explores the possible public health risks of climate change in New England. Projected risks include the movement of disease vectors into new areas as well as increasing exposures to diseases already present. This thesis examines such risks as well as the adaptive capacity through the synthesis of current modeling literature and interviews with regional experts in biology, economics, sociology, and public policy and previous literature. The aim of this project is to provide a better understanding of the health risks and the possible responses to climate change.

**Students in Helicase Biology Club and Faculty Panelists**

***Student-Faculty Panel Discussion: Where is Science in 2018?***

**Gregory Anderson, Biology, advisor**

This panel, presented by Helicase Biology Club, is a discussion covering the current state of science in the public sphere. Due to the recent occurrences in the current administration as well as the direction that science is heading, it is more important than ever to engage in a discussion about the responsibility of future scientists. Professors as well as students will explore and share their perspectives on how the implementation of new policies has impacted scientific research, the accessibility of scientific results and their correct interpretations, social media's influence on these factors, and finally how to ensure the integrity of science for future generations.

**Cristopher Hernandez Sifontes '18**

***Procesos y Vidas: The Spanish Inquisition in Spain and Its Colonies***

**Baltasar Fra-Molinero, Spanish, advisor**

Manuscripts detailing the Inquisitorial process illuminate the historical record in a myriad of ways. These documents not only reveal important facts about the operations of the Holy Office but also help us uncover patterns in the daily lives and behaviors of the ordinary individuals who came into contact with it. Amid the elaborate bureaucratic impulses of this an imperial institution such as the Spanish Inquisition, we also come across pressing details of colonial interactions and the function of religion as a method of control both in Spain and its colonies around the world.

**Samuel Hersh '18**

***Investigation of Kinetics of Phosphoinositide Metabolism in tsA201- and HT22-Cells***

**Martin Kruse, Biology and Neuroscience, advisor**

Phosphoinositides comprise a family of rare phospholipids found on all cellular membranes. Hydrolysis of a particular phosphoinositide, PI(4,5)P<sub>2</sub>, results in closure of several potassium channels which fundamentally alters neuronal activity. Due to their important role in controlling neuronal activity, information about kinetics of phosphoinositide hydrolysis and synthesis is of great interest for a better understanding of neuronal activity, however, little information about the factors controlling these reactions in neurons is currently available. In this project, the phosphoinositide metabolism of HT22 cells, an immortalized cell line derived from hippocampal neurons, is being characterized to improve our understanding of neuronal phosphoinositide metabolism.

**Jane Hodell '18 – see Dylan Carson '18**

***Contemporary Social Issues: Sociological Perspectives***

**Heidi Taylor, Sociology, advisor**

**Sadie Homeier '18**

***STIs on the Rise***

**Susan Langdon, Psychology, advisor**

How we engage with the current climate surrounding sexually transmitted infections within the United States is paramount to understanding our country's health. Research on human papillomavirus (HPV), in particular, reveals the ways in which STIs like HPV are impacted by family dynamics, but also ideologies of government administrations, extent of healthcare coverage, and social and cultural contexts. By looking into sexual health on a micro and macro level, especially when it comes to the socio-ecological perspective, allows for a deeper understanding of our country's health in an area that is often overlooked.

**Riley Hopkins '18 – see Keila Ching '19**  
*Performance, Choreography, and Collaboration: The Dance Research Process*  
**Rachel Boggia, Dance, advisor**

**Nell Houde '18 – see Adair Andre '18**  
*Sustainability Initiatives at Bates* ♻️  
**Jane Costlow, Environmental Studies, advisor**

**Sophie Jensen '19**  
*Independent Study on the Curatorial Process*  
**William Low, Bates College Museum of Art, advisor**  
My independent study focuses on the curatorial process of developing an exhibition from the Bates College Museum of Art's permanent collection in the museum's Synergy Space Gallery. Throughout the semester I have collaborated with the staff at the museum to develop an exhibition that features the poster portfolio from the IVAW (Iraq Veterans Against the War). In addition to preparing that exhibition, I have participated in various museum processes such as cataloguing, conducting research on art and artists, exhibition design, developing accompanying text for the exhibition, curatorial statements, and have communicated with faculty in order to help coordinate programming related to what is happening at the museum.

**Eliza Jimenez '18 and Ezra Oliff-Lieberman '18**  
*(Dis)Remembering and Political Socialization: Transnational Perspectives on the Nakba*  
**Cynthia Baker, Religious Studies, advisor**  
In 1948, nearly 800,000 Palestinians were forced to flee their homes and approximately 500 villages were destroyed amidst Israel's struggle for an independent Jewish state. Palestinians refer to these events as the *Nakba*, Arabic for "catastrophe." Memory of the Nakba and its ongoing effects continue to impact the Israeli-Palestinian conflict as well as identity construction and political socialization among Palestinian refugees and Jewish Israelis. Eliza Jimenez and Ezra Oliff-Lieberman present their research on contemporary effects of the Nakba, specifically focusing on the political socialization of Jordanian-Palestinian family units and the Nakba's complicated place in Jewish-Israeli collective memory and current anti-occupation efforts. Eliza and Ezra conducted Bates-funded fieldwork in Jordan and Israel, respectively.

**Matthew Johnson '18**  
*Egon Schiele, Sanctifier of the Damned: Viennese Expressionism and the Culture of Prostitution*  
**Edward Harwood, Art and Visual Culture, advisor**  
At the turn of the 20th century, the streets of Vienna were filled with prostitutes and the commercial sex trade. Simultaneously, the avant-garde artist Egon Schiele (1890-1918) began to use the young women of the street as muses, painting and drawing them in his highly erotic and sexual expressionist style. While the deeply pious Austro-

Hungarian Empire saw prostitution as a disease, Schiele instead, I argue, embraced it and painted prostitutes in order to "sanctify" them and cleanse them of sin. This presentation explores Schiele's depiction of prostitution and self-fashioning as a Christ-like figure with the ability of sanctification.

**Anna Kandel '18**  
*Application of the Underlying Chemistry in PbTiO<sub>3</sub> for the Design of Lead-free Perovskites*  
**Geneva Laurita, Chemistry and Biochemistry, advisor**  
Lead titanates are excellent piezoelectric materials because of their high Curie temperatures and polarizability. These materials are widely used in sensors, actuators, and solar technology, but as lead is toxic, there is a need to develop lead-free alternatives. In an effort to find viable replacements, our work focuses on synthesizing perovskites that draw from the chemistry of the Pb-based perovskites. This work will contribute to the overall understanding of the chemistry involved in the high-performing Pb-based materials and how similar chemistries can be employed for targeted performance.

**David Katzman '18**  
*An Exploration of Bioinformatic Tools to Locate Transcription Start Sites in *Borrelia burgdorferi**  
**Paula Schlax, Chemistry and Biochemistry, advisor**  
RNA can form complex secondary structures by base-pairing interactions and hydrogen bonding between nucleotides. In this project, we explore whether these structural motifs are conserved around processed 5' ends that were identified in *Borrelia burgdorferi* transcripts. Using the bioinformatic tools CLUSTALW, RNAfold, and RNAalifold, as well as novel Python scripts, nucleotide base pairing and secondary structure were analyzed. Our data will be used to design sequence variants that can be used to determine the functional significance of these structures.

**Caitlin Keady '18 and Sarah Sachs '18**  
*Establishing a Localized Offset Program for Bates Travel Emissions* ♻️  
**David Das, Center for Global Education, advisor**  
In 2010 Bates pledged to achieve carbon neutrality by 2020. However, recent calculations reveal that we will not reach our goal through reduced energy consumption and fuel switching alone. Greenhouse gas emissions associated with student and staff travel have not previously been accounted for, yet estimates indicate that these emissions are substantial. We have constructed local and affordable offset initiatives that can be monitored internally or through a peer verification system, allowing the college to bypass expensive verification. This system would also establish a network of institutions committed to carbon neutrality, which would encourage student collaboration on a broader scale.

**Kiana Keller '18**

*Regulation of Calcium Release by Inositol 1,4,5-Trisphosphate Receptor-binding Protein Released with Inositol 1,4,5-Trisphosphate (IRBIT) through Interaction with Inositol 1,4,5-Trisphosphate Receptors (IP3R)*

**Martin Kruse, Biology and Neuroscience, advisor**  
IP3R binding protein released with inositol 1,4,5-trisphosphate (IRBIT) binds to inositol 1,4,5-trisphosphate receptors (IP3R). In this study, calcium signals in IRBIT knock-out (IRBIT-KO) and wildtype cells will be compared to analyze IRBIT's role in regulating calcium release from intracellular stores. IRBIT-KO cells will be created using clustered-regularly-interspaced-short palindromic-repeats (CRISPR)-Cas9 to inactivate IRBIT in tsA201-cells. Western blot and confocal microscopy will be used to analyze IRBIT protein expression levels and protein localization. Ca<sup>2+</sup> signals will be analyzed by confocal microscopy. The results from this study will expand our knowledge about IRBIT's function from biochemical assays to dynamic in vivo cell signaling.

**Fahim Sakil Khan '20 – see Chris Bradna '20**  
*Automatic Selection of Galaxies with Signatures of Extraplanar Gas in the MaNGA Survey*  
**Aleksander Diamond-Stanic, Physics and Astronomy, advisor**

**Chaesong Kim '18**  
*Research on Personal Narrative, Intimacy, and Technology in Theater through Making and Performing 엄마 (Dear Mom), an Interdisciplinary Multimedia Solo Performance*

**Timothy Dugan, Theater, advisor**  
Elevation of the domestic and the staging of personal narrative have been effective protests against the canon, mainstream, and patriarchy for performance artists and video artists since the 1960s. As an art maker, I find this form to be relevant and potent, especially during this political climate around the globe, where celebrating the human is becoming a pressing issue. Art heals, according to Anna Halprin. Art is everything and anything, according to Fluxus. But Anne Bogart draws a clear distinction between "discharge" and "art" that arises out of "compression." So what is my discharge and what is my compression?

**Gift Kiti '18**  
*A Classroom Snapshot: Characterization of Introductory STEM Courses at Bates*

**Lynn Mandeltort, Chemistry and Biochemistry, advisor**  
Motivated by Bates' commitment to inclusive pedagogies, our work characterizes introductory STEM classrooms using the Classroom Observation Protocol for Undergraduate STEM (COPUS). Extensive research has shown the effectiveness of active learning and other inclusive pedagogies, especially for underrepresented

students. In our ongoing analysis, we find that professors use a range of pedagogical tools within an individual course. Despite that variety, professors have unique instructional practices that can be placed into instructional profiles. These snapshots of teaching will serve as a resource for professors to engage in reflective practice and determine the extent to which they are realizing their pedagogical goals.

**Claudia Krasnow '18**  
*Pray For Me, I Steal Money*

**Jessica Anthony, English, advisor**  
After spending a semester crafting and polishing a collection of short stories for my English thesis, I will share a brief reading of my work. My fiction presents characters consumed by their own moral doubts. They each traverse their own dubious psychological terrain to find solace.

**Samuel Lagerstrom '18**  
*Witness Behavior: An Evaluation of Cues*

**Amy Douglass, Psychology, advisor**  
How do witnesses behave in lineup procedures? How do triers of fact evaluate the accuracy of eyewitnesses? As of 2017, the United States Department of Justice recommends that lineup procedures be videotaped, but the exact purposes of keeping these tapes is unclear. Thus, there is much to explore as to how videotaping lineup procedures can improve the conditions that increase accurate identifications and decrease erroneous identifications. This study codes videos of a lineup procedure (N = 157) to examine witness behavior in target present and target absent conditions.

**Sophie Landes '21 – see Adair Andre '18**  
*Sustainability Initiatives at Bates* ♻️  
**Jane Costlow, Environmental Studies, advisor**

**Christopher Lietz '18 – see Brooke Benedict '18**  
*Comparative Analysis of Chiral Solvating Agents for NMR Enantiomeric Differentiation of Amines*  
**Thomas Wenzel, Chemistry and Biochemistry, advisor**

**Kai Lindsey '18**  
*Is This a Dream, or Am I a Cat?*

**Helen Weetman, Asian Studies, advisor**  
Ishikawa Jun's *Yume No Satsujin (Dreaming a Murder)*, and Natsume Sōseki's *Wagahai Wa Neko-dearu (I Am a Cat)* revolve around a story with a "different" perspective. *Yume No Satsujin* presents the story of a lawyer who dreams of killing his dentist, only to find out later that his dentist was indeed murdered. In *Wagahai Wa Neko*, a haughty cat details the lives of several middle-class Japanese people. What exactly are these perspectives, and how do both stories utilize them? What can we learn about the characters, authors, Japanese society, and Japan as a whole through a different perspective?

**Charles Lipscomb '18 and Senyo Ohene '20**  
*Energetic Gaseous Outflows from Compact Starburst Galaxies*

**Aleksander Diamond-Stanic, Physics and Astronomy, advisor**

We present analysis on 12 compact starburst galaxies at  $z \sim 0.6$  that exhibit gaseous outflows with speeds greater than 1000 km/s. The data on our galaxies comes from the Wide Field Camera 3 on the Hubble Space Telescope which took images in three different filters (475 nm, 814 nm, and 1600 nm). These images have allowed us to obtain measurements of the morphological properties of our galaxies via Sersic modeling. Having accurate estimates of these physical characteristics will help us test the viability of various star-formation feedback models.

**India Lissak '18**

*Neuroepigenetics: Targeting TET3 Inhibition as a Mechanism for Improving Memory in Patients with Alzheimer's Disease*

**Andrew Kennedy, Chemistry and Biochemistry, advisor**

Epigenetic mechanisms have been found to play a critical role in the consolidation and storage of long-term memories. One such mechanism, DNA methylation, results in the silencing of certain genes which thereby improve the capacity for long-term memory formation. DNA demethylation, the reverse reaction, is catalyzed by Ten-eleven Translocation (TET) enzymes, of which there are three isoforms, and results in gene activation. Increased DNA demethylation levels have been linked to memory impairments, thereby indicating a link between elevated TET enzyme activity and decreased memory capacity. Selectively knocking down TET2 was found to result in enhanced memory in wildtype mice models and it was presumed that given the similarities between TET2 and TET3, that selectively knocking down TET3 would yield similar results. However, preliminary data suggests that TET2 and TET3 have different functions surrounding memory capacity.

**Oriana Lo Cicero '20**

*Doping Studies of Brownmillerite Thermoelectric Materials*

**Geneva Laurita, Chemistry and Biochemistry, advisor**

Thermoelectric materials have the potential to make energy systems significantly more effective by converting waste heat into electrical energy. The challenge with current thermoelectric materials is reducing the thermal conductivity while maintaining a high electrical conductivity. My work focuses on potential thermoelectric materials with the brownmillerite structure,  $A_2B_2C_5$ . My goal is to develop and understand brownmillerite materials with the intent of finding new compounds with high electrical and low thermal conductivity. By performing X-ray and neutron diffraction, accurate structural data can be analyzed, allowing for more concrete conclusions about the

structure and its influence on the function of these materials.

**Henry Loeffler '18**

*Heterogeneity of Biophysical Properties within the Mitral Cell Layer of the Mouse Olfactory Bulb*

**Jason Castro, Neuroscience, advisor**

Input to the olfactory bulb from receptors in the olfactory epithelium is organized topographically, and the epithelium is divided into rough zones defined by olfactory receptor clades. However, comparatively little is known about how output from the bulb through mitral cells, the olfactory bulb's principal relay neurons are organized. On one hand, information may be homogeneously processed along the mitral cell layer, while on the other hand, information may be organized heterogeneously into distinct zones of mitral cells with distinct biophysical properties. Patch clamp experiments were conducted to examine how the mitral cells differ biophysically along layer's the dorsoventral axis. Several biophysical properties were examined with a special focus on h-current or sag potential, which has been shown in past studies to be diversely expressed along the mitral cell layer.

**Zhe Luo '18**

*A Strategy to Cope with Discrimination? A Study of East Asian Taking on English Names*

**Alex Borgella, Psychology, advisor**

The effects of orthodox English names used by East Asians during their employment are the focus of the current research. This study investigates this issue through having participants, playing the roles of employers, give ratings on likelihood of hiring based on resumes, and exploring the interactive effect of names (common English name vs. typical Chinese name) and the types of occupation (software engineer vs. client consultant).

**Zachary Magin '18**

*The Relationship Between Purpose in Life and Salivary Cortisol Reactivity to a Social Stressor*

**Georgia Nigro, Psychology, advisor**

Purpose in life is associated with better physical and psychological well-being. One explanation as to how purpose benefits individuals' physical and psychological health is through its ability to reduce stress. The goal of this study was to investigate the relationship between purpose and stress, specifically evaluating the relationship between purpose and salivary cortisol reactivity to a laboratory-induced social stressor. The results of this study have clinical implications for the importance of invoking purpose in patients with physical and psychological health problems to promote healing through the buffering effect that purpose may have on stress.

**Melanie Mait '18**

***The Role of Nfe2 in the Development of the Inner Ear in Zebrafish***

**Larissa Williams, Biology, advisor**

Hearing loss is a large problem in the United States, so it is important to have a complete knowledge of how the inner ear develops to gain a better understanding of the mechanisms of hearing loss. The zebrafish otic vesicle offers a unique model to study ear development due to the transparency of their embryos and the high degree of conservation between their genome and humans. In order to investigate the role of Nfe2 in otolith formation, morpholino oligonucleotides (MOs) were used to knock down nfe2 expression, and the effects on the neuromasts and hair cells in the vesicle were observed.

**Avery Margerum '18**

***Why Bates Needs A Course On Anarchy***

**Dennis Browne, Russian, advisor**

For a period of fifty years, anarchy spread and took hold across Europe as revolution and upheaval shook the continent. This presentation explores the growth of anarchism in France, Russia, and Spain in the late 19th and early 20th centuries and places it in context with the development of complex state apparatus, burgeoning nationalist movements, and changing hierarchies of industry and class. It then emphasizes how such an analysis may be implemented as an interdisciplinary course bringing together aspects of politics, history, European studies, and how a reexamination of a misunderstood movement may help reflect on contemporary politics and society.

**Kawai Marin '18**

***Rooted in Movement: A Search for the Sacred among the Trees***

**Jane Costlow, Environmental Studies, advisor**

Today our culture predominantly adheres to the notion that we are entirely separate from the environment thus causing unprecedented rates of environmental destruction. If we take the time to slow down, we can consciously opt for a different perspective. My presentation discusses my work done on an Otis Fellowship. I will present the story from my pilgrimage, which draws on inspiration from John Muir along with Henry Thoreau and seeks to build on the tradition of ecological contemplation through walking by elaborating on their principles of ecological interconnectedness and the sacredness of nature. Through my walk I used multiple artistic media to document my daily contemplative practice and upon return I recreated my journey on an online story-map. By resurrecting such principles I aimed to deliberately slow down and act from a point of stillness, fostering a deeper more conscious relationship to the environment and my inner self while also encouraging others to do the same.

**Colby Marsh '21 – see Maddie Hallowell '20**

***Choreography, Composition, and Code***

**Rachel Boggia, Dance; Matthew Jadud, Digital and Computational Studies; and William Matthews, Music, advisors**

**Students in MATH 495H, Elliptic Curve Cryptography**

***Topics in Public Key Cryptography***

**Adriana Salerno, Mathematics, advisor**

Public key cryptography is at the center of most secure transactions, from using a credit card online to sending and signing secure messages. The security of a cryptosystem relies on solving difficult math problems such as factorization of large numbers and the discrete logarithm problem. Each student in this course has studied various methods of encryption, including the RSA cryptosystem, the Diffie-Hellman key exchange, Elliptic Curve Cryptography, and methods of breaking these encryptions. Their posters present some of these topics in detail.

**Rose May '18**

***Testing for Gene Expression of the MHC Class II  $\alpha$  in the Leach's Storm-Petrel***

**Donald Dearborn, Biology, advisor**

The major histocompatibility complex (MHC) is a crucial region in the vertebrate genome that greatly influences immune defense by encoding proteins that present antigens to T cells. This region is known for its high level of polymorphism, and such diversity is linked to the immunological ability of an organism to defend against the ever-changing pathogen landscape. Indeed, the evolutionary phenomenon of gene duplication has been cited as a means for generating new MHC genes, which contributes to the region's high polymorphic character. Here we characterize the MHC class II  $\alpha$  of the Leach's storm-petrel, *Oceanodroma leucorhoa*, focusing on exon II in order to determine if the region is polymorphic. We sought to characterize the expression of two genes of the class II  $\alpha$  region, DAA and DBA, which were first amplified with extracted gDNA from two storm-petrels using locus-specific primers in polymerase chain reactions (PCR). These were then sequenced using the Sanger sequencing technique, which revealed that the gDNA amplified from each bird contained both DAA and DBA genes. To confirm the expression of the two genes present in gDNA, mRNA from the same two storm-petrels was extracted and also subject to PCR and subsequent sequencing. Sequencing analysis of both gDNA and mRNA sequences using Sequencher software revealed that both DAA and DBA were expressed in one storm-petrel, suggesting that the MHC class II  $\alpha$  of the Leach's storm-petrel is polymorphic.

**Maria Maza San Vicente '18**

***Creative Cognition through Shared Mental Models***

**Michelle Greene, Neuroscience, advisor**

This project investigates how shared mental models contribute to individual creative cognition. The creativity paradigm was composed of the Remote Associations Task and Alternate Uses Task in order to measure convergent and divergent thinking respectively. EEG-based Brain-Computer Interface systems enable visualization of creativity through changes in alpha power. It is hypothesized that shared mental models will increase alpha power and positively contribute to individual creative cognition and perceived creativity. Understanding how shared mental models are generated in a dynamic team setting allows us to better comprehend human creativity and how to can enhance our own creative potential.

**Catherine Merton '18**

***Synthesis of Building Blocks for O-mannosylated Glycans***

**Jennifer Koviach-Côté, Chemistry and Biochemistry, advisor**

O-mannosylation involves the covalent linkage of mannose to a serine or threonine residue of a protein. O-mannosylation is important in modulating cell-matrix interactions, cell adhesion, and cell-cell signaling. The biological importance of glycosylation is well known, but poorly understood due to the variability and heterogeneity of polysaccharides in biological systems. Therefore, chemical synthetic methods can yield homogenous, pure substances which can be used to probe the biological function of specific glycan structures. The purpose of this research is to organically synthesize the building blocks of O-mannosylated glycans, and to use these building blocks to form complete O-mannose structures.

**Kiyona Mizuno '18**

***Mold-Making and Slip-Casting Ceramics***

**Susan Dewsnap, Art and Visual Culture, advisor**

I explored the methods of mold-making and slip-casting functional ceramics in an independent study, learning techniques that allowed me to make identical copies of my work. Using forms thrown on the wheel, I made three one-piece molds of a small cup, a larger tumbler, and a bowl. I learned about the formulation of plaster, casting slip, and glazes for the finished pieces, ultimately doing eight castings of the three forms and firing them at the end of the semester.

**Rakiya Mohamed '18**

***A Comparative Analysis on Lead Detecting Instruments and Commercial Home Kits***

**Xiaqing Xu, Chemistry and Biochemistry, advisor**

This thesis report explores the strengths and limitations of different instruments used to detect lead presence in multiple media. This report finds that professional lab

instruments such as a Graphite Furnace Atomic Absorption Spectroscopy (GF AAS) work to produce quantitative results of lead presence while home testing kits generally report results qualitatively. Home testing kits are reported to have some limitations as far as price and accuracy are concerned. This report also presents an alternative home testing kit for water sources proposed by Lin et al. (2017). This instrument is very cheap to make, does not report false results, and has a longer lifespan when compared to other home testing kits that are on the market currently.

**Joshua Moise-Silverman '18**

***Examining Jewish Ethical Responses to Molecular Three-parent Babies***

**Cynthia Baker, Religious Studies, advisor**

Advances in reproductive sciences have resulted in the ability for one child to be born of three different parents. Specifically, pronuclear transfer technology has facilitated the treatment of mitochondrial diseases via the introduction of third-party mitochondrial DNA. Children born of this technology are related to three individuals, raising interesting questions within the Jewish religion. Specifically, are children born to two Jewish parents, with the addition of DNA from a non-Jewish woman, still considered to be Jewish by birth? Examining past Jewish biomedical precedent as well as modern religious and ethical assessments can aid in determining whether or not children born from this procedure would be recognized as Jews by the Orthodox Jewish community.

**Sophie Mortman '18**

***Dystopia in Toni Morrison***

**Sue Houchins, African American Studies, advisor**

Many of Toni Morrison's novels have been analyzed through its use of magical realism, but they have rarely, if ever, been examined under a dystopia lens. Dystopia takes these magical elements a step further, and considers what role they play in the context of political, social and economic factors. From *The Bluest Eye* to her latest books, Morrison has not shied away from creating and allowing her characters to inhabit these complex, off-kilter worlds. What, I ask, makes these worlds different from the worlds we live in, and what is her purpose in creating certain parts of that world?

**Kinsey Moser '18**

***Examining the Influence of Atmospheric and Weather Conditions on Nocturnal Bird Migration of Thrushes in Maine Using Acoustic Monitoring***

**Donald Dearborn, Biology, advisor**

Migrating birds have been observed to produce nocturnal vocalizations that are theorized to maintain flock structure, stimulate migratory behaviors, and coordinate movements of the flock. This study looks at acoustic monitoring of avian migration ecology within four species of thrushes in Maine. This thesis looked to examine which species were

most dependent on atmospheric conditions by looking at the phenology of the species, examining the central tendency of passage date between species, and whether call rates varied positively with cloud cover. Bicknell's Thrush are predicted to be more likely to migrate based on atmospheric and weather conditions than Gray-Cheeked Thrush.

**Sophie Moss-Slavin '18 – see Zsofia Duarte '18**  
*Research and the Public Good: Multi-disciplinary Explorations*

**Darby Ray, Harvard Center for Community Partnerships, advisor**

**Reed Mszar '18**  
*Examining the Association between Familial Hypercholesterolemia (FH) and Diabetes Mellitus among Local FH Patients Enrolled in the CASCADE FH Registry*

**Karen Palin, Biology, advisor**

Familial hypercholesterolemia (FH) is a common hereditary condition caused by genetic mutations affecting lipoprotein metabolism and leads to a 20-fold increased risk for developing premature cardiovascular disease. Epidemiological research shows that in some populations FH prevalence is disproportionately elevated due to a founder effect. This founder effect may contribute to the high prevalence of FH among the local Lewiston-Auburn population, about a third of which is of Franco-American heritage. Cross-sectional analysis utilizing data from the CASCADE FH Registry showed that local FH patients (n = 231) have an increased likelihood for experiencing a myocardial infarction and have higher rates of hypertension, diabetes mellitus, and smoking compared to patients nationwide.

**Katrina Muñoz '18**  
*ECT and DBS: Depression Treatments and Their Perceived Threat to Personal Identity*

**Michael Dacey, Philosophy, advisor**

Major Depressive Disorder (MDD) presents a serious global health concern. Despite improvements in the treatment of MDD, the rates and overall societal burden of this debilitating disorder continue to increase. Moreover, approximately one-third of depressed individuals are resistant to traditional psychotherapeutic and psychopharmacological treatments. The urgency to find alternative treatments for these patients has led to further exploration of brain stimulation therapies, such as electroconvulsive therapy (ECT) and deep brain stimulation (DBS). Research demonstrates the potential these therapies have to effectively alleviate depressive symptoms. However, although rare, patients receiving these treatments have experienced concerning acute and long-term psychological side effects, even when the treatment outcomes are considered successful. These side effects

appear to threaten patients' personal identity, and raise both clinical and theoretical concerns. In this thesis, I explore the meaning of personal identity and the self, the phenomenology of MDD, and how MDD influences a patient's personal identity. Additionally, I provide an in depth explanation of the history, efficacy, and side effects of ECT and DBS as MDD treatments. Lastly, I make two arguments stemming from the clinical and theoretical perspectives of these treatments. First, from the clinical perspective, it is necessary to continue researching and refining these brain stimulation therapies given compelling evidence on their antidepressant effects. Second, the theoretical perspective illuminates how ECT and DBS can disrupt patients' personal identity, but also how physicians can attempt to prevent such threats to personal identity.

**Gwen Muscato '18**  
*Use of Western Blotting and Chromatin Immunoprecipitation to Investigate Nfe2 Binding in Zebrafish (Danio rerio)*

**Larissa Williams, Biology, advisor**

Transcription, the first step of gene expression, is essential to basic cellular and developmental processes. The transcription factor Nfe2 likely plays a large role in erythropoiesis and the oxidative stress response in zebrafish, a model organism, but previous studies suggest that its importance may reach beyond that and a lot about Nfe2 remains unknown. This project utilizes Western blotting to determine when in zebrafish development Nfe2 is present and chromatin immunoprecipitation (ChIP) to determine where it binds on DNA in an attempt to better understand this transcription factor and its role in development and pro-oxidant induced developmental toxicity.

**Kenza Nadifi '21 – see Maddie Hallowell '20**  
*Choreography, Composition, and Code*  
**Rachel Boggia, Dance; Matthew Jadud, Digital and Computational Studies; and William Matthews, Music, advisors**

**Julia Nemy '18 – see Victoria Dobbin '18**  
*An Image of Local Francophonie: Djiboutian Experiences in Lewiston and Cultural Transmission at Lewiston High School*  
**Alexandre Dauge-Roth, French and Francophone Studies, advisor**

**Senyo Ohene '20 – see Charles Lipscomb '18**  
*Energetic Gaseous Outflows from Compact Starburst Galaxies*  
**Aleksander Diamond-Stanic, Physics and Astronomy, advisor**

**Ezra Oliff-Lieberman '18 – see Eliza Jimenez '18**  
*(Dis)Remembering and Political Socialization: Transnational Perspectives on the Nakba*  
Cynthia Baker, Religious Studies, advisor

**Sunjay Pai '18**  
*The Impact of Bumblebee Wing Flexibility on Body Torque in Response to Varied Collisions*  
Andrew Mountcastle, Biology, advisor

Previous work has shown that wing flexibility serves several functions in mitigating wing wear, enhancing flight maneuverability, and influencing body torque. In this study, we tested the effects of obstacles being placed in front of a bumblebee's wing during different portions of the wing stroke. In response to collision with this obstacle, the body of the bumblebee will perform a saccade in order to compensate for the collision. Our goal was to understand the role of flexible wings in filtering impact forces at different phases in the stroke cycle.

**Sadie Mae Palmatier '18**  
*The Community Rating System: Incentives for Building Climate Resilience* ♻️

**Lynne Lewis, Economics, advisor**  
Building and incentivizing resilience in the face of sea-level rise is a priority in many communities. To achieve this end, the Federal Emergency Management Agency (FEMA) and the National Flood Insurance Program (NFIP) created the Community Rating System (CRS) as an incentive program designed to enhance flood resilience in communities. Through the analysis of two communities affected by Hurricane Sandy in 2012, this presentation will explore how the measurement of climate resilience informs decision making about flood insurance policy and or/adapted migration.

**Sarah Panzer '18**  
*Self-Compassion as Potential Moderator between Negative Social Comparison and Negative Self-Perception among Social Media Users*

**Helen Boucher, Psychology, advisor**  
Social network sites (SNSs) tend to highlight the most positive aspects of one's life. Consequently, SNSs provide users with abundant opportunities to engage in negative social comparison, that is, the tendency to feel that others are better off relative to oneself. Negative social comparison on SNSs can have harmful effects on self-perception, but research suggests self-compassion, which entails being patient and kind toward one's own failures and shortcomings, could be an effective buffer against such effects. The current study examines self-compassion as a potential moderator between negative social comparison when using SNSs and negative self-perception.

**Ivette Partida '18 and Emma Zulch '18**  
*Isolation of in vitro Ubiquitylated Encephalomyocarditis Virus 3C Protease Conjugates*

**Glen Lawson, Chemistry and Biochemistry, advisor**  
Eukaryotic cells are able to specifically degrade proteins through the ubiquitin-proteasome system, which marks proteins for proteasome-mediated degradation by the covalent attachment of ubiquitin protein molecules. We are investigating the role ubiquitylation of the encephalomyocarditis virus (EMCV) 3C protease, plays during the infection of mouse cells by this member of the cardioviral subgroup of the picornavirus family. Our laboratory has shown that polyubiquitylation of the 3C protease results in the reduction of its concentration in EMCV-infected cells, but we have also discovered pathways that result in 3C protease monoubiquitylation, a modification that does not lead to the degradation on the protein. We hypothesize that monoubiquitylation inhibits 3C protease catalytic activity, thereby acting as a host cell antiviral defense mechanism. To test this hypothesis, we are developing a procedure for isolating ubiquitylated 3C protease for use in kinetic studies of its catalytic activity. We are optimizing an in vitro ubiquitylation system that includes the purified ubiquitylation pathway enzymes E6AP/UBE3A, UbcH7, and UBE1 and purified EMCV 3C protease and ubiquitin that contains the hemagglutinin (HA) affinity tag. This is coupled with a procedure we are developing to isolate the ubiquitylated conjugates by anti-HA affinity chromatography.

**Summer Peterson '18**  
*Implicit Effects of Diminutive Gendered Language Usage*  
**Michael Sargent, Psychology, advisor**

Research suggests there is a strong association between women and weak/nurturing traits, rather than traits associated with strength/competence. The current research aims to determine whether that association persists today, and to what extent perceived competence is affected by labeling (i.e., "woman" versus "girl"). The participants will complete the Modern Sexism Scale to gauge their inclinations toward sexist ideology and participate in one of four Go/No-Go Association Tasks (GNAT). The predicted findings include a greater competence association of males overall and mature labeling, and a greater difference in competence perception of men/boys than women/girls.

**Halley Posner '18**  
*Understanding Nuclear Politics*  
**Jason Scheideman, Politics, advisor**

I will be presenting the findings from my independent study, "Arms Control and Security." Here, I will decode the seemingly esoteric and foreign world of nuclear politics. I will explain what causes states to pursue a nuclear agenda, why some states chose to give up their nuclear weapons,

and how we can pursue a policy of nonproliferation in today's world. To illustrate these concepts, I will use North Korea and other nuclear-capable states as my case study.

**Roderick Pratt '18**

***Order, Surplus, and Silence: Latent Narratives of 1381 in the Canterbury Tales***

**Sylvia Federico, English, advisor**

This presentation will trace meta-narratives of the Rebellion of 1381 within Fragment I of Chaucer's *Canterbury Tales*, and will rationalize the absence of the "Plowman's Tale" in an otherwise complete array of the medieval estates. Although scholars often interpret the Knight and Miller to be representative of the disintegration of 14th-century social order, I posit that the structures of vertical authority which inform reward and punishment in these tales are mutually supportive of one another. The Miller's replacement of the Plowman as a vanguard of feudal conventionalism suggests Chaucer's acknowledgement of shifting social structures post-revolt.

**Hannah Prince '18**

***The Intricacies of Reflective Practice and Its Impact on a Cohort of Homeless Youth within an Education Program***

**Georgia Nigro, Psychology, advisor**

Homeless youth lack the stability and means to access consistent education and practice self-regulatory skills. In order to mediate this discrepancy, programs that serve these youth should offer alternative learning that specifically improves self-regulation while being sensitive to the consequences and complications of homelessness. Research on self-regulation provides evidence that effective reflective practice includes 1) goal-setting, 2) feedback, and 3) targeted reflection. In order to benefit our community partner, New Beginnings, a homeless youth shelter, I implemented a reflective framework comprised of worksheets that utilized these three facets of self-regulation. This framework was shown to produce a number of positive effects amongst the youth, including increasing frequency of accomplished goals, increasing focus through setting consistent expectations, and increasing connections between long-term goals and daily work.

**Brigid Quinn '18 – see Dylan Carson '18**

***Contemporary Social Issues: Sociological Perspectives***

**Emily Kane, Sociology, advisor**

**Laura Rand '18**

***Major Histocompatibility Complex (MHC) Class IIA in Storm-petrels***

**Donald Dearborn, Biology, advisor**

The highly polymorphic genes of the major histocompatibility complex (MHC) are associated with vertebrate defense against disease. We initiated a project to sequence MHC IIA in mated pairs of Leach's storm-petrels

and discovered two MHC Class IIA genes in this species, likely resulting from gene duplication. These two IIA genes appear to be highly diverged from each other. Therefore, I explore the possibility that the heterodimeric protein produced by the different alpha and beta monomers fits into the Coevolved Pairs hypothesis, in which a particular one of the IIA genes is always linked with a particular one of the IIB genes. The mechanisms of how these proteins bind together has yet to be determined. The variation produced by these additional copies of Class IIA and IIB genes may be critical for a storm-petrel's ability to resist foreign pathogens and/or in recognizing mates. Further studies will test these hypotheses.

**Dylan Rasch '18**

***Synthesis of D-Apiose for Manufacturing and Researching Luteoside A, B, and C***

**Jennifer Koviach- Côté, Chemistry and Biochemistry, advisor**

For my thesis I have studied the synthesis of the extremely rare sugar, D-apiose, from the compound L-ribose. D-apiose is a necessary component for the larger sugar molecules luteoside A, B and C, which have been found to act as antiviral agents for the disease respiratory syncytial virus. In order to further study this, we aim to develop a synthesis plan to prepare these molecules independently, whereas before they have only been isolated from plant roots.

**Olga Revzina '18**

***Round and Round Like a Squirrel on a Wheel: Exploring the Role of Negative Affect and Rumination in Pain Responses and Mood Changes***

**Kathryn Low, Psychology, advisor**

Nonsuicidal self-injury (NSSI) is dangerous behavior, often resulting in a variety of maladaptive outcomes (Victor & Klonsky, 2014). Negative affectivity (NA), the emotional tendency to experience frequent and intense negative emotions (Guerry & Prinstein, 2010), is an underlying temperamental vulnerability associated with NSSI. Rumination, a cognitive technique of addressing negative emotions that involves repetitively focusing on symptoms of distress and on their possible outcomes (Nolen-Hoeksema, 2008), is another predictor of NSSI (Hilt, Cha, Nolen-Hoeksema, 2008). My two studies sought to examine 1) whether rumination impacts mood improvements during pain and 2) possible mechanisms for mood improvements during pain.

**Students in RHET 391J, Film Festival Studies**

***Your BFF: Student Organizers Preview and Discuss the Inaugural Bates Film Festival***

**Jonathan Cavallero, Rhetoric, advisor**

The Bates Film Festival (BFF) is a collaboration among Bates undergraduates and the college's faculty, staff, alumni/ae, parents, and friends. Students are involved in

every aspect of the festival's organization, planning, and execution. Together, we foster an appreciation for the artistry of screen media; showcase film and television history; and present work that serves as a platform for productive discussions that engage topical social and political issues. During this panel, students in Rhetoric 391J, Film Festival Studies, preview a selection of titles that will be shown at the festival and discuss the challenges they have faced throughout the planning process.

**Meg Robinson '20**

***Bismuth-Based Transparent Conducting Metal Oxides***  
**Geneva Laurita, Chemistry and Biochemistry, advisor**

Transparent conducting perovskites are crystals with the form  $ABO_3$  that can be utilized in solar cells, LEDs, LCDs and touchscreens. Bismuth, when placed in the B-site of the lattice, gives properties that are optimal for applications in transparent conductors. While Bi+4 is the expected oxidation state of the cation, in reality, it presents as a combination of Bi+3 and Bi+5, with no trace of Bi+4. With a template structure of  $BaBiO_3$ , we can alter and enhance the properties of the perovskite through A-site and B-site substitution, n and p type doping, and other variations.

**Bennett Rollins '18**

***Fluorescence Lifetime Images in STED Microscopy***  
**Travis Gould, Physics and Astronomy, advisor**

The purpose of this study was to create a data processing tool that generates fluorescence lifetime images (FLIMs) from data recorded using a stimulated emission depletion (STED) microscope. This is achieved through a MATLAB program which compiles and averages the fluorescence decays of a set number of identical sample gold beads. Specifically, the decay times are found by analyzing a three-dimensional array where each layer is an image of the sample at a later timestep. Exponential decay curves are then fit across the layers, which produce the desired fluorescence decay times. This study ended with the successful completion of the FLIM generating program.

**Benjamin Roop '18**

***Computational Analysis of Genomic Patterning in the Brain***

**Jason Castro, Neuroscience, advisor**

Much of the brain shows modularity across different sensory modalities. Within the superficial olfactory bulb, neural circuits propagate signals in a parallel way. However, little is known about the organization of the deep olfactory bulb. Building upon previous students' thesis work, this project tests the hypothesis that the bulb's circuits are divided into modules that can be defined by patterns of gene expression. We use computational methods to search for such patterns in the mitral cell layer at a finer scale than has ever been used before.

**Rachael Rosow '18**

***The Influence of the Framing Effect on Behavioral Intention to Download a Public Health App***

**Amy Douglass, Psychology, advisor**

The Androscoggin Drug Disposal app is a smartphone application that contains information about the locations of permanent drug disposal boxes around Androscoggin County as well as drug abuse prevalence, resources, and safe medication handling techniques. This app was created as part of my biology senior thesis in response to the rising prevalence of prescription misuse and overdoses, specifically in Androscoggin County, ME. The aim of the current study is to predict someone's behavioral intention to download the Androscoggin Drug Disposal app in order to determine the best procedure for promoting this public health app. This study will administer a questionnaire comparing several different advertisements via the MTurk web service. The results will have implications for effectively advertising and implementing this public health app in the local community as well as for similar apps at large.

**Stephen Rowe '18**

***Targeting Terrorist Leaders***

**William d'Ambruoso, Politics, advisor**

This thesis argues that contrary to the traditional theoretical thought, high levels of institutionalization and charismatic authority are not mutually exclusive in terrorist organizations. Furthermore, when high levels of charismatic authority and institutionalization are prevalent within a terrorist organization, leadership removal will reduce the lethality of terrorist organization because charismatic leaders choose to structure their organizations in ways that enhance their own authority within their organization making them vulnerable to leadership removal.

**Anna Roy '18**

***Colonization, Decolonization, and Conditional Cash Transfer in Bolivia***

**Sonja Pieck, Environmental Studies, advisor**

I am writing my thesis about (de)colonization through a government CCT (conditional cash transfer) program in Bolivia that aims to serve women and their children under two years old. I also did research while studying abroad in Bolivia and cervical cancer prevention in women. I imagine that I will discuss these experiences in this panel.

**Bridget Ruff '18**

***A History of Equation Solving from the Babylonians to Galois***

**Adriana Salerno, Mathematics, advisor**

For millennia humans have been searching for the solutions to various polynomial equations. In 1832, Évariste Galois ended the search for the solution to quintic equations when

he proved Neils Heinrick Abel's hypothesis of the Insolubility of the Quintic. Using equation solving as a case study for how mathematics develops, this poster will trace the roots of early mathematics in Babylon, China, India, and the Middle East to Europe during the Renaissance, the Enlightenment, and the French Revolution. Further, it asks about how the search for solutions connects people with vastly different conceptions of numbers to a single theory.

**Allegra Sacco '18 – see Zsofia Duarte '18**  
*Research and the Public Good: Multi-disciplinary Explorations*

**Darby Ray, Harvard Center for Community Partnerships, advisor**

**Sarah Sachs '18 – see Caitlin Keady '18**  
*Establishing a Localized Offset Program for Bates Travel Emissions* ♻️

**David Das, Center for Global Education, advisor**

**Aria Sanders '18**  
*A Literature-based Comparative Analysis of Triacylglycerides Present in Breast Milk and Infant Formula and their Contribution to Infant Metabolism*  
**Glen Lawson, Chemistry and Biochemistry, advisor**  
Fat is the main source of energy present in human milk (~50% of the total energy). Specifically, triacylglycerides constitute a majority of the lipids, or fats, and are essential for further development of an infant's organs after birth. Both human and formula milk contain triacylglycerides composed of fatty acid chains esterified to glycerol. Maternal triacylglycerides are derived from storages within the body or synthesized de novo in the mammary glands, however, many infant formulas contain triacylglycerides originating from vegetable oils. Unlike the predetermined fats in infant formulas, human milk triacylglycerides are subject to change. One known contributor to fatty acid change is the maternal diet, which influences the concentration of fats present in breast milk. In this study, I focus on the major fatty acids present in human and formula milk. I am interested in how fatty acid positions (sn-1, sn-2, or sn-3) on triacylglycerides and fatty acid concentration affects metabolism and storage in neonates, in relation to obesity.

**Gwen Savino '18**  
*Depth of Processing in Object Substitution Masking*  
**Todd Kahan, Psychology, advisor**

Four-dot object substitution masking (OSM) is a type of visual masking in which a briefly displayed target stimulus is surrounded by four small dots. Typically, participants are more accurate in reporting the presence of the target when the dots and target disappear simultaneously as opposed to when the dots persist on the screen after target offset. This study seeks to explore the effects of image-level versus object-level similarities between the target and mask on the

recovery effect that is sometimes found in OSM. Through studying these effects, we hope to clarify the extent to which targets are processed during OSM.

**Emma Schiller '18**  
*An Investigation into the Effects of Electronic Healthcare Records in Improving Patient Outcomes in Hospitals in the United States*

**James Hughes, Economics, advisor**  
This study investigates the Electronic Healthcare Record (EHR) capabilities of hospitals across nine states in the northeast of the United States, and how those capabilities improve patient outcomes as measured by patient readmissions and deaths. Seven EHR capabilities are explored both individually and together as a scored variable. Our study finds some varying results across the different capabilities but overall identifies a positive impact of EHR capability on patient outcomes. These observed improvements will help to pave the way for further digital transformation efforts in the healthcare industry, efforts which are essential to improving the industry as a whole.

**Kyle Schlueter '18**  
*How Fidget Spinners Affect Attention: An Examination of Alerting, Orienting, and Executive Control*

**Todd Kahan, Psychology, advisor**  
This experiment analyzed the validity of the claims made by large companies marketing fidget spinners. These devices are purported to help individuals with attention deficits yet surprisingly little is understood about how these devices affect attention. The current study used a contemporary experimental methods for measuring attention, called the Attentional Network Task, in order to determine how these devices influence different attentional networks. Results from this reaction time experiment help to make clear the ways in which fidget spinners affect alerting, orienting, and executive control.

**Allen Schroeder '21**  
*Positional Cloning of the Genetic Mutation and Histological Analysis of Femoral Nerve Axonal Degeneration in the NM4803 Mouse Mutant*

**Donald Dearborn, Biology, advisor**  
Some neurodegenerative disorders that result in muscle paralysis can be caused by spontaneous genetic mutations. NM4803 mice develop hind limb paralysis during the first 3-12 months of age caused by a genetic mutation. Maintaining the mutation through selective breeding makes NM4803 a valuable animal model for understanding the genetics of neurodegeneration. This project is an attempt to narrow the location of a single nucleotide polymorphism that results in femoral nerve degeneration and motor dysfunction in NM4803 mice. Identifying the specific gene mutation in NM4803 may help to understand the genetics of human disorders like amyotrophic lateral sclerosis (ALS) and muscular dystrophy.

**Julie Self '18**

***The Role of Diagnostic Objects in the Temporal Dynamics of Visual Scene Categorization***

**Michelle Greene, Neuroscience, advisor**

Humans are able to effortlessly categorize scenes, but it is still unclear how we do so. This study investigates the ways in which diagnostic objects contribute to scene categorization. Electroencephalography (EEG) will be recorded while participants classify un-altered scenes and scenes where either diagnostic or random objects have been obscured via localized phase randomization. EEG and behavioral data will be decoded using a support vector machine (SVM) classifier to determine how and when diagnostic objects contribute to scene categorization. This study will ultimately provide a better understanding of the mechanisms and timeframe of visual processing.

**Tommy Sheils '21 – see Maddie Hollowell '20**

***Choreography, Composition, and Code***

**Rachel Boggia, Dance; Matthew Jadud, Digital and Computational Studies; and William Matthews, Music, advisors**

**Keenan Shields '18 – see Zsafia Duarte '18**

***Research and the Public Good:***

***Multi-disciplinary Explorations***

**Darby Ray, Harvard Center for Community Partnerships, advisor**

**Hyewon Shin '18**

***Women in Business: The Experience of Asian American Women in the Tech Industry***

**Emily Kane, Sociology, advisor**

Women in the 21st century are as educated as men, as qualified as men, and are playing a variety of roles in the economy. However, in business, discrimination based on gender and race still affects modern women in various overt and covert ways. In this thesis, I specifically focus on the experience of Asian American women in the technology industry. I provide in-depth insight into the experience of Asian American women regarding gender and racial discrimination at their workplace derived from extensive interviews. The interview outcomes vary from the literature: unlike what literature suggests, the interviews describe the experiences of women in tech in a relatively positive light. The interviewees stated they did not experience any type of direct discrimination based on gender or race, and faced no sexual harassment or related misconduct incidents in the tech industry.

**Courtney Sinclair '18**

***Gender Representations in Diverse Picture Books***

**Krista Aronson, Psychology, advisor**

Children's books have been shown to have a positive

impact on a child cognitively, socially, mentally, and physically. Despite this popularity and influence, negative racial and gendered stereotypes are still prevalent. Previous studies have shown the adverse effects of reading books with these stereotypes due to children's internalization of their environment and high regard for the books they read. An analysis of gender portrayals was done to determine the gendered visual cues present in books featuring human characters of color published since 2002. The findings demonstrate that certain gendered and racialized visual cues do exist in diverse picture books. Implications of these findings could help influence publishers, educators, and parents to expose children to diverse books that do not incorporate gender stereotypes.

**Hannah Singer '18 – see Dylan Carson '18**

***Contemporary Social Issues: Sociological Perspectives***

**Emily Kane, Sociology, advisor**

**Hannah Slattery '18**

***Impervious Surface Cover: Impact on Sedimentation Rate and Dissolved Oxygen in the Hart Brook*** ♻️

***Watershed, Lewiston, ME***

**Beverly Johnson, Geology, advisor**

As cities across the United States have urbanized, the amount of impervious surfaces (pavements, rooftops, cement, etc.) have risen steeply. Increases in imperviousness impact natural hydrologic processes in a watershed and can lead to a decrease in water quality (high sediment loads and low dissolved oxygen levels). In Lewiston, ME, the Hart Brook watershed has 22% impervious surface cover (ISC) and the stream is classified as an urban-impaired watershed due to dissolved oxygen levels below 75% saturation and excessive nutrient deposition. The purpose of this study is to evaluate the timing and extent of urbanization and its impact on sediment dynamics and water quality.

**Ariel Abonizio Soares '20**

***Being Here: Photographing the Body***

**Edward Harwood, Art and Visual Culture, advisor**

*Being Here* is a digital photography series that explores the experience of bodily existence. By engaging in a collaboration between body and camera, the artist aims to investigate the power of images to render their own body simultaneously legible and abstract. The project is grounded in the research and analysis of artists working with the human body such as Arno Rafael Minniken and John Coplans. Combining formal elements of composition, color theory, abstraction, and self-portraiture, *Being Here* is an initial exploration of artistic embodiment. In its playful discomfort, each picture invites the audience to collectively inhabit unidentical bodies.

**Daniel Sparks '18**

***The Effects of Restorative Justice on Adolescent Development in the State of Maine***

**Georgia Nigro, Psychology, advisor**

While conventional justice today is generally punitive, focusing on delivering retribution to criminal offenders, an alternative known as restorative justice takes a more holistic perspective, focusing on community reconciliation, taking responsibility, and personal growth and development. The present study looks at data collected by the Restorative Justice Institute of Maine from 152 adolescent offenders who underwent a restorative justice process. Using pre- and post-intervention surveys designed to assess levels of personal development and participant evaluations of the process, this study intends to shed light on the practice's propensity to produce satisfied victims and socially productive offenders.

**Nathaniel Stephenson '18**

***Reviving Gogol: Diary of a Madman in the Modern Scope***

**Katalin Vecsey, Theater, advisor**

Nikolai Gogol's short stories and plays examine his contemporary Russian society through a satirical lens. In reading them, many of his themes appear familiar to the modern reader, as questions of bureaucracy, identity, purpose, and power resonate through his work. During the course of this thesis project, Gogol's 1835 short story, "Diary of a Madman," was adapted and modernized into a one-person stage play set in the modern era. Informed by my research and training at the Moscow Art Theater School, I performed the play at both Bates College and the Kennedy Center American College Theater Festival regional competition.

**Charlie Stewart '21 – see Maddie Hallowell '20**

***Choreography, Composition, and Code***

**Rachel Boggia, Dance; Matthew Jadud, Digital and Computational Studies; and William Matthews, Music, advisors**

**Olivia Stockly '18**

***Unintended Consequences of Protocol Change: Prehospital Spinal Assessment and Immobilization***  
**Shuhui Yang, Chinese, advisor**

This study took patients reported by Maine Medical Center emergency physicians through a post-admission data collection from August 2016 through July 2017. Pre-hospital emergency medical services run sheets as well as hospital charts were used to create a complete timeline and track injuries and treatment from prehospital interaction through discharge from the hospital. Forty-three patients were admitted in the timeline and had a data sheet filled out following their admission. This physician-created sheet allowed for exposure of discrepancies in care and transportation of patients with possible spinal injuries in the

prehospital environment. The number of discrepancies documented suggests further study across the state would be beneficial to identifying the capabilities of EMS providers in spinal assessment and immobilization.

**Caleb Stotz '18**

***Natural Gas Well Implementation on the Susquehanna River: A Hedonic Property Value Analysis***

**Lynne Lewis, Economics, advisor**

This thesis examines the impact of natural gas well location choice on property values in Wyoming County, PA, a community on the Susquehanna River. Using a hedonic property value analysis, I estimate the marginal willingness to pay for distance to the Susquehanna River and fracking wells within the county. The variables for distance to the river and living downstream from a well both become higher negative values when interacted with a dummy for before and after fracking. These results suggest that the socioeconomics of a community on a body of water are impacted by the implementation of fracking.

**Haoyu Sun '19**

***Drug Discovery Research: TET1 Enzyme Inhibitor***

**Andrew Kennedy, Chemistry and Biochemistry, advisor**

The central hypothesis of my research is that learning recruits biochemical mechanisms in neurons that are necessary for the formation of long-term memory. The specific aim of this project is to design, create, and evaluate drugs that increase the fidelity of DNA methylation, in order to improve memory function in Alzheimer's disease and rare disorders of memory.

**Nicole Taikeff '18**

***The Unifying Mechanisms of Obesity and Type II Diabetes in Relation to Insulin Resistance***

**Glen Lawson, Chemistry and Biochemistry, advisor**

Obesity and Type II diabetes (T2D) are worldwide growing epidemics that are associated with each other because obesity engenders insulin resistance (IR). I hypothesize that obesity and T2D are linked by two mechanisms that are precursors of IR. This includes free fatty acid (FFA) secretion and fat tissue inflammation found in diet-induced obese rodents and humans. Content analysis is used to interpret previous experiments and results done on these mechanisms. It is necessary to understand the processes that bridge these pathologies to improve therapies that allow an increase in quality of life, life expectancy, and decrease in national healthcare costs.

**Mats Terwiesch '18**

***Artificial Intelligence and Healthcare: Forecasting Patient Length of Stay at the Central Maine Medical Center***

**Michael Murray, Economics, advisor**

Operating with limited beds, medical resources, and physicians, hospitals are constantly allocating resources

under conditions of scarcity. Misallocation of resources and operational inefficiencies are a substantial driver of the United States' strikingly high healthcare costs. Accurately forecasting the duration which a specific patient will stay in a hospital could assist hospital decision makers in optimizing their workflow and allocating their resources efficiently. In this talk, I explore machine-learning methods to forecast the length of stay of patients at the Central Maine Medical Center (Lewiston, ME). I also discuss how these methods could be implemented and their operations management implications.

**Sophia Thayer '18**

***Tourism as an Industry of Dispossession: Malaga Island and Wabanaki Presence along Maine's Coast***

**Joseph Hall, History, advisor**

Tourism in Maine contributed to the process of Wabanaki removal and invisibilizing. The development of tourism along the coast of Maine helped some Mainers sustain their ways of life because the industry commodified a white rustic experience. For other Mainers, those who were poor and non-white, like many Wabanakis, discrimination and marginalization increased with the development of tourism. Tourism became an industry of relocation, dispossession, and erasure of Wabanaki people. This research project explores how the Malaga Island eviction, which centers on mixed white and African American identities, is also a story of Wabanaki identity and presence erasure in Maine.

**Margaret Trombly '18**

***Study-Abroad Students as Sex Tourists***

**Erica Rand, Art and Visual Culture & Gender and Sexuality Studies, advisor**

Do the sexual behaviors of female study-abroad students constitute a form of sex tourism? Are female study-abroad students sexually motivated in their choice of travel destinations? Does a binary exist between men, who travel for sex, and women, who travel for romance, reinforcing an essentialist binary of carnal male desire vs. romantic feminine sensitivity? Through my thesis research, I seek to answer these questions and explore the sorts of gendered, racial, power, and class dynamics to which these behaviors give rise. Drawing parallels with current literature regarding sex tourism, I also seek to discover if the actions of these students constitute a form of exploitation, while also exploring the legitimacy of the sex/romance tourism binary.

**Joe Tulip '18 – see Zsofia Duarte '18**

***Research and the Public Good: Multi-disciplinary Explorations***

**Darby Ray, Harvard Center for Community Partnerships, advisor**

**Kenyata Venson '18**

***The Effects of Cannabis on the Endogenous System in Glaucoma***

**Lee Abrahamsen, Biology, advisor**

Glaucoma, a disease defined by high intraocular pressure that damages the optic nerves in the eye, is one of the leading causes of blindness globally. It is estimated that glaucoma affects more than 66 million individuals worldwide with at least 6.8 million becoming bilaterally blind. There are numerous forms of glaucoma, however, this presentation will focus on three types: primary open angle, angle closure, and normal tension glaucoma. Through discovery of these three types of glaucoma, I explored factors that contribute to the disease and focused on how cannabis effects the endogenous system and whether it is efficient enough to act as a treatment for glaucoma. The role of cannabinoids in retinal circuitry and vision is supported by the presence of the endogenous cannabinoids in the endocannabinoid system. From this we know that cannabinoids are an option for treatment but research suggests the use of medical marijuana in glaucoma is not likely a viable choice considering that it is a unilateral treatment and is not enough to stop the progression of the disease.

**Xiaomeng Wang '19**

***Imaging of RNA Localization in B. burgdorferi***

**Paula Schlax, Chemistry and Biochemistry, advisor**

In *Borrelia burgdorferi*, the RNA composition varies rapidly when the bacteria shifted from tick to mammal. Recent works also show that some organisms regulate their RNA composition by the physical locations of those RNA molecules. To explore their spatial distribution in *Borrelia* cells, RNA molecules are visualized using fluorescent in situ hybridization with state-of-art stimulated emission depletion microscope, which yields higher lateral resolution. The localization patterns between different RNA molecules are also examined with the standard confocal microscope. The imaging results suggest that in stationary phase cells, different RNA transcripts locate in variable locations, instead of co-localizing together.

**Kelly Wassarman '18 – see Joseph Alp '18**

***Designing TET Enzyme Inhibitors to Enhance Learning and Memory***

**Andrew Kennedy, Chemistry and Biochemistry, advisor**

**Max Watson '18**

***Effects of Flower Density and Mixing of Rewarding and Unrewarding Flowers on Bumble Bee Visitation Rates and Flower Constancy***

**Carla Essenberg, Biology, advisor**

One of the core intentions of conservation ecology is understanding the factors that affect the reproductive

success of threatened plant populations. Plant species that do not offer rewards to their pollinators may face unique risks, as pollinators can learn to avoid their flowers in order to optimize their foraging efficiency (Ollason & Ren, 2002). For this reason, the ecological conditions of their environment, including conspecific flower density, density of rewarding species, and degree of mixing with rewarding flower species may be crucial in determining an unrewarding species' reproductive success. For our experiment, we artificially replicated an environment in which both flower density and degree of mixing between unrewarding and rewarding flowers were individually manipulated. We recorded visitation rates to the unrewarding flowers as well as the frequency of switching between rewarding and unrewarding artificial flowers. The goal was to reveal to what degree flower density and mixing with rewarding species affect the reproductive success of the rewarding species.

**Libby Wellington '20 – see Maddie Hallowell '20**

***Choreography, Composition, and Code***

**Rachel Boggia, Dance; Matthew Jadud, Digital and Computational Studies; and William Matthews, Music, advisors**

**Rayne Whitten '18**

***Maxi-K Channels: Dependent on Phosphoinositides?***

**Martin Kruse, Biology and Neuroscience, advisor**

Phosphoinositides, members of a family of rare phospholipids, affect the activity of several ion channels in neuronal cells, thereby influencing neuronal excitability. Maxi-K channels are essential for regulation of excitability in superior cervical ganglion neurons; however, it is unclear whether phosphoinositide levels influence Maxi-K channel activity. To test for Maxi-K channel phosphoinositide dependence, whole-cell patch-clamp recordings in human embryonic kidney cells expressing Maxi-K channels are used to monitor channel activity while altering cellular phosphoinositide levels by activation of 1) a G protein-coupled receptor (M 1R), 2) a voltage-sensitive lipid phosphatase (Dr-VSP), and 3) an engineered lipid phosphatase (Pseudojanin).

**Gillian Wilcox '18**

***Glomerular Structure and Extracellular Matrix***

***Composition in the Human Olfactory Bulb***

**Jason Castro, Neuroscience, advisor**

Neurogenesis during adulthood and deficits in neurodevelopmental disorders make the human olfactory bulb (OB) an ideal avenue for studying development. The structure of the OB has mostly been visualized in 2D even though it is innately 3D. This study will examine the volume of the human glomerulus (the first point of contact from olfactory sensory neurons (OSNs) to the OB) and the OB carbohydrate composition using optically cleared post-mortem human OBs and selective plane illumination

microscopy. From this study, we can better understand the human OB structure and the supportive role of carbohydrates in neural development.

**Amelia Wilhelm '18**

***RNA Degradation in *Borrelia burgdorferi****

**Paula Schlabach, Chemistry and Biochemistry, advisor**

The Lyme disease causative agent, *Borrelia burgdorferi*, cycles between a tick vector and vertebrate host during the infectious cycle. Virulence factors rpoN, rpoS, ospA, ospC, and dbpA are essential for the acquisition and transmission of *B. burgdorferi*, but their mRNA degradation pathways have not been characterized. In this study, transcription was arrested in cells cultured in three osmolar environments, mimicking the vector and host. The decay rates of these transcripts were studied using qRT-PCR. Preliminary results suggest that these transcripts may be differentially degraded in different osmolar conditions, providing a characterization of mRNA decay and gene regulation in *B. burgdorferi*.

**Frank Williams '18**

***The Feeling of Power and How It Impacts Shooter Bias***

**Michael Sargent, Psychology, advisor**

Shooter bias research suggests that the race of a target person, who is presented as either armed or unarmed, influences observers' decisions to shoot or not shoot. This study investigates how the concept of power affects shooter bias of different racial targets. Participants will be randomly assigned to three power prime conditions: personal power, social power, and control. I hypothesize that priming either form of power will lead to better differentiation between armed and unarmed targets than in the control condition. Furthermore, priming personal power will magnify racial bias, whereas priming social power will diminish racial bias.

**Brianna Wilson '18**

***Genetics is a Significant Factor in the Etiology of***

***Postpartum Depression***

**Pamela Baker, Biology, advisor**

Postpartum depression (PPD) is prevalent worldwide. Low activity alleles of gene polymorphisms with strong evidence for PPD association include COMT Val158Met and MAOA-uVNTR. These genetic variants of COMT and MAOA decrease synthesis of COMT and MAOA, proteins that break down neurotransmitters. With less protein available, larger amounts of neurotransmitters remain, leaving the individual more reactive to stress and PPD. A low activity allele of ESR1 gene is also significant, resulting in less Estrogen Receptor alpha (ER $\alpha$ ) protein, a transcription factor for estrogen-responsive genes. Less ER $\alpha$  decreases the body's estrogen levels, already extremely low following childbirth, increasing the likelihood of PPD.

**Avery Wolfe '18**

***Striving for Just Sustainability in Transit Systems: A Case Study of Complete Streets Policies in Lewiston*** 🌱

**Francis Eanes, Environmental Studies, advisor**

In 2013, Lewiston adopted a Complete Streets policy; the product of a national movement seeking to improve the sustainability and equity of urban transit systems by ensuring consideration for all modes of transportation. In an era where the just sustainability concept is becoming more widely used and relevant, it is necessary to investigate the effectiveness of policies like Lewiston's Complete Streets in achieving sustainability and human justice goals. I am exploring the degree to which Lewiston's Complete Streets policy reflects just sustainability ideals and whether the outcomes match the policy's purpose, focusing on elements of language, values, and process.

**Laura Wolfley '18**

***Navigating the "In-between": Sociological Research on Negotiating Multiple Racial and Ethnic Identities among Biracial and/or Bicultural Students at Bates College***

**Heidi Taylor, Sociology, advisor**

Considering that multiracial and multicultural students are an underrepresented and understudied population of the student body, there is a gap in acknowledging the positive and negative experience of the student who belongs to several demographic social constructs. This study was designed to understand how social environments shape identity negotiation and development of identities among multicultural and/or multiracial students at Bates College. In-depth interviews were conducted with students who self-identified with more than one culture or race. Their stories were then analyzed and interpreted. Results highlight the day-to-day personal account of the interviewees and how they negotiate their identities on campus.

**Kasey Wood '18**

***Elucidation of RNA Degradation Rates in the Causative Agent of Lyme disease, *Borrelia burgdorferi****

**Paula Schlax, Chemistry and Biochemistry, advisor**

In 1982, the causative agent of Lyme disease, the spirochete bacterium *Borrelia burgdorferi* was identified and isolated from its deer tick host, *Ixodes scapularis*. It has since been found that the pathogenic nature of *B. burgdorferi* is closely related to its dynamic outer surface protein (Osp) composition, which allows bacterial cells to survive the environmental change induced by transmission from tick to mammalian host. Thus, understanding the mechanisms underlying the differential expression of Osps in response to environmental changes is essential in elucidating the pathogenesis of Lyme disease. In this

research, click chemistry is being applied to assess degradation rates of nascent RNA in *B. burgdorferi*. Click chemistry refers to the synthetic linkage of small molecules with oligonucleotides, proteins, and polysaccharides. These synthetic molecules are integrated in vivo without disrupting normal cellular processes and can then be conjugated to reporter groups, enabling reliable detection and isolation of biomolecules. This research aims to clarify the role that RNA degradation plays in *B. burgdorferi*, whose responsive protein expression facilitates its virulence in humans.

**Hanning Grace Xu '21 – see Maddie Hallowell '20**

***Choreography, Composition, and Code***

**Rachel Boggia, Dance; Matthew Jadud, Digital and Computational Studies; and William Matthews, Music, advisors**

**Chialin Yu '18**

***Studying Smallpox Evolutions under the SIR Model***

**Meredith Greer, Mathematics, advisor**

We used SIR model to study the evolutions of smallpox across times and regions and understand how demographical changes contribute to the repeated international outbreaks.

**Ke Zhao '18**

***Synthesis of Mannose Building Blocks for Preparation of O-Mannosylated Glycans***

**Jennifer Koviach-Côté, Chemistry and Biochemistry, advisor**

O-mannosylated glycoproteins are characterized by attachment of an oligosaccharide through mannose to serine or threonine of a protein. These glycoproteins are found in skeletal muscle tissue, and are in abundance in nerve tissue. They are critical for human development and disruption of the glycoprotein results in various diseases such as muscular dystrophy. However, the functions of these glycoproteins are not well understood, and their extraction from cells is difficult. In order to provide m1, m2, and m3 glycans for further study, we have prepared four mannose building blocks using standard carbohydrate synthesis techniques. In addition, the incorporation of these mannose building blocks into oligosaccharides using automated solution phase oligosaccharide synthesis will be presented.

**Emma Zulch '18 – see Ivette Partida '18**

***Isolation of in vitro Ubiquitylated Encephalomyocarditis Virus 3C Protease Conjugates***

**Glen Lawson, Chemistry and Biochemistry, advisor**