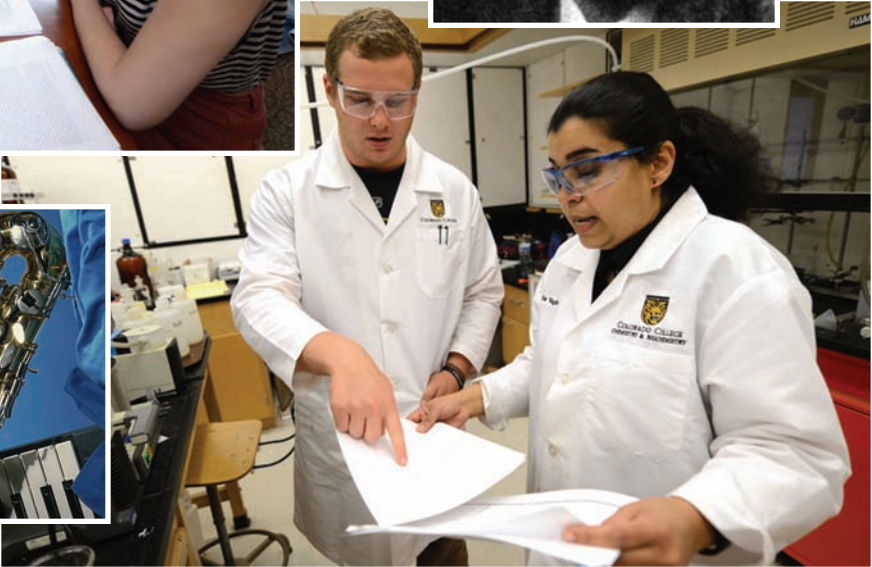
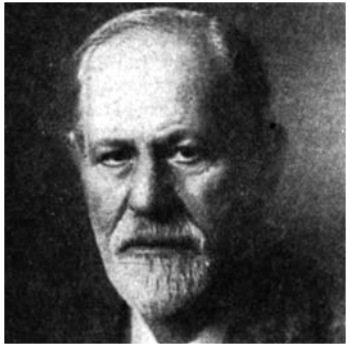


# 2014 Summer Undergraduate Collaborative Research Symposium

Monday, September 15, 2014



COLORADO COLLEGE



# Summer Undergraduate Collaborative Research Symposium

Monday, September 15, 2014 • Edith Kinney Gaylord Cornerstone Arts Center

## Cornerstone Main Space

3:30–

3:55 p.m. **Opening Remarks and Faculty Perspectives on Researching with Undergraduates**

..... Sandi Wong, *Dean of the College/Dean of the Faculty*  
Faculty members Ryan Bañagale, *Music* and Lori Driscoll, *Psychology*

4–

4:45 p.m. **Student Perspectives on Collaborative Research I: Concurrent Paper Sessions**

## Cornerstone Screening Room

### Session A: Disciplines as Lenses and Object of Study

ABSTRACT A1 – **Deviance in the Fin-de-Siècle: Misfits and Sexual Inverts**

..... Erik Laitos

ABSTRACT A2 – **The State of National Undergraduate Comparative Literature Programs**

..... Han Sayles

ABSTRACT A3 – **Psychoanalysis and the Cinema**

..... Alex Suber

## Cornerstone Room 301

### Session B: Modeling and Learning in Systems

ABSTRACT B1 – **Genetic Algorithms, Neural Networks, and the Blood-Brain Barrier**

..... Lou Brand

ABSTRACT B2 – **Stochastic Modeling of Quorum Sensing in Gram-Negative Bacteria**

..... Leigh Nicholl, Brendan Davis

ABSTRACT B3 – **The Role of RNA Binding Protein CPB-3 in Dendrite Morphogenesis  
in *C. elegans***

..... Maggie Wolf

## Cornerstone Room 302

### Session C: Environmental Systems: Studying Localized Changes

ABSTRACT C1 – **Micrometeorology and Tree Growth Dynamics at the Alpine Treeline on Pikes Peak**

..... Emma Marshall, *et al.*

ABSTRACT C2 – **Climate Change and Chronology of the Last Glacial-Interglacial Transition,  
North-Central Great Basin, USA**

..... Erica Evans

ABSTRACT C3 – **The Log Canoe: Oyster Farming on the Chesapeake Bay**

..... Madelyn Santa

## Cornerstone Main Space

4:50–

5:35 p.m. **Student Perspectives on Collaborative Research II: Poster Presentations**

4:50–

5:15 p.m. **Poster Session 1: Abstracts 10–23**

5:10–

5:35 p.m. **Poster Session 2: Abstracts 24–39**

## Cornerstone Main Space

5:40– **Closing Remarks and Presentation Awards**

6 p.m. .... Faculty members Phoebe Lostroh, *Biology* and Jane Murphy, *History*

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# Student Perspectives on Collaborative Research I: Concurrent Paper Sessions

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## Session A: Disciplines as Lenses and Object of Study

### ABSTRACT A1 – Deviance in the Fin-de-Siècle: Misfits and Sexual Inverts

*Student Researcher* . . . . . Erik Laitos  
*Faculty Advisor* . . . . . Susan Ashley, *History*

I worked on two distinct research projects with Professor Ashley over Summer 2014. The first project involved Professor Ashley’s manuscript for a planned book, provisionally entitled “Misfits.” This work captures the development of empiricism in medicine in the late-19th century. Professor Ashley examines records of medical analyses, diagnoses, and treatments of “misfits” from that era; that is, those individuals whose aberrant personalities, behaviors, and diseases removed them from “normal” society. The student researcher reviewed the manuscript and suggested revisions to the draft, as well as completed extensive bibliographic work. This research project required two very different skills: looking for and correcting small, detailed errors in the text and citations, as well as identifying the unifying theme of the work and making recommendations to clarify it throughout. The second project involved a more selective research effort. Professor Ashley has written a draft of an article on the subject of sexual inversion, the theory propounded by a number of sexologists in the late 19th century that attempted to explain homosexual urges (but not actions). For this project, the student researcher explored the existing works of scholars relevant to this subject, particularly theorists of queer theory. The student researcher attempted to locate where within this existing literature Professor Ashley’s article fits, and whether it would benefit from a deeper reading of some of these scholars. This project called for much more nuanced skills, such as conducting an extensive review of the literature, finding the most relevant works, and making selective recommendations to Professor Ashley based on their relevance to her article.

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### ABSTRACT A2 – The State of National Undergraduate Comparative Literature Programs

*Student Researcher* . . . . . Han Sayles  
*Faculty Advisor* . . . . . Corinne Scheiner, *Comparative Literature*

This summer I worked with Professor Corinne Scheiner to create a report for the American Comparative Literature Association to evaluate the state of national undergraduate comparative literature programs. This report is an update from a report that Professor Scheiner created in 2005, entitled “Report on the Undergraduate Comparative Literature Curriculum,” which appeared in *Profession* in 2006. The data is entirely composed of self-reported responses to a survey created by Professor Scheiner and two fellow CC students. The survey they created was distributed during the Spring 2014 semester to every comparative literature program in the country that offers a bachelor of arts degree. Of the 117 emails we sent out to comparative literature programs across the country, only one school reported back to us that they did not have a program. Out of this new pool of 116 comparative literature programs, 54 respondents completed the survey, so our data represents 47 percent of undergraduate comparative literature programs in the country. The survey included more than 100 questions, many of which were free responses or multiple-part inquiries compiled into a single question. I worked closely with Mark Saviano, statistical/technical director for psychology, to learn how to analyze data by using SPSS (Statistical Program for the Social Sciences) and Excel. I learned to clean up and organize data, how to run dozens of functions with SPSS to attain specific graphs or tables, and how to make sense of contradictory responses and find meaning from raw data. Professor Scheiner and I are in the process of finalizing all of our results so we can begin to write the primary section of the report, which will draw conclusions from our survey about a large variety of topics including the institutional locations of comparative literature programs, the presence of global studies and the effects of film and new media studies on the discipline.

ABSTRACT A3 – **Psychoanalysis and the Cinema**

*Student Researcher* . . . . . Alex Suber  
*Faculty Advisor* . . . . . Scott Kzrych, *Film and New Media Studies*

The cinematic experience remains a pillar of the American mythos. Every year, millions of moviegoers pile into dark, crowded theaters and are presented with images taken from near and far. We laugh, cry, and grimace, but rarely do we consider the psychological experience of watching films. By deconstructing the cinematic experience itself and explicating the relation of the viewer to the characters on screen, we may begin to better understand the force at the heart of cinema: Desire. As both a student of philosophy and an aspiring filmmaker, I seek to understand the unconscious contract between spectator and screen. Using the framework of psychoanalysis and the ideas of post-modern thinkers such as Jacques Lacan and Slavoj Zizek, my research aims to unveil the unconscious processes implicit in the cinematic medium. As the summer progressed my research began to revolve around the role of desire within the cinematic experience. By breaking down both the content and form of films, I was able to come to conclusions regarding desire’s role in the creation of narrative tension and suspense. My analysis of an array of contemporary films reveals that this primary unconscious contract between spectator and screen is wed by the evocation of desire in the spectator. Every film poses a visual or audio question, which — by the nature of the contract — it promises to answer. Throughout film history, this question appearing in the audio-visual field can be seen and its workings unveiled. With the aid of psychoanalytic thought, I attempt to reformulate the classic conflict-resolution model. In addition to research regarding the role of desire in film at large, I was able to synthesize a meta-analysis of the film-going experience itself. What effect does breaking the fourth wall have on the viewer and why? Why is it necessary to see films in darkened and silent rooms? And how is the movement-time image able to (re)present the human experience? By reworking the conception of ‘film as escapism’ into a dualistic relationship between screen and audience, my research aims to challenge the conventional wisdom and open up new space for filmmaking form.

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**Student Perspectives on Collaborative Research I: Concurrent Paper Sessions**

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**Session B: Modeling and Learning in Systems**

ABSTRACT B1 – **Genetic Algorithms, Neural Networks, and the Blood-Brain Barrier**

*Student Researcher* . . . . . Lou Brand  
*Co-Researcher* . . . . . Matthew Dickinson  
*Faculty Advisors* . . . . . Matthew Whitehead, *Mathematics and Computer Science*;  
Sally Meyer, *Chemistry and Biochemistry*

Certain kinds of drugs, like those that treat African sleeping-sickness and other brain-related diseases, need to be able to pass through the blood-brain barrier (BBB) to cure the patient. A medicinal synthetic chemist cannot simply look at the structure of a molecule to determine whether or not it will pass through the BBB. Instead, the chemist relies on expensive programming packages, or animal testing, to determine whether or not a drug will reliably get into the brain. During our summer project we attempted to create an artificial neural network that would reliably predict whether or not a drug would pass through the BBB. We hypothesized that genetic algorithms, an evolutionary programming technique, would help improve the speed at which artificial neural networks learned. The methods used to create the hybrid genetic-neural networks employ basic theoretical concepts from neuroscience, mathematics, computer science, and biology.



## ABSTRACT B2 – Stochastic Modeling of Quorum Sensing in Gram-Negative Bacteria

*Student Researcher* . . . . . Leigh Nicholl  
*Co-Researcher* . . . . . Brendan Davis  
*Faculty Advisor* . . . . . David Brown, *Mathematics and Computer Science*

Bacteria may seem primitive, but in reality they have a highly complex system of communication. They emit protein signals, formally known as quorum signals, which allow them to relay messages that in turn control cell proliferation, secretion, and other regulatory mechanisms. In many cases, the signals must reach a certain threshold level in the external cellular environment in order to cause any change. Once the threshold is reached, the system is described to be “on.” This bistability, in that the system can be classified as on or off, is intrinsic to bacterial quorum sensing. We explored the behavior of a hypothetical bacterium’s bistability switch. After sifting through the dozen or so papers on quorum sensing and with David’s guidance, we were able to draft a basic quorum sensing cascade of events, such as signal reception, gene activation, transcription, and then translation of the signal. We decided to use software called COPASI, which is designed to simulate biochemical reactions. We spent a lot of time learning COPASI: how to enter reactions, what kinds of graphs it could produce, and how to simulate a system for long periods of time. It was a big challenge trying to get the software simulations to behave the way we know they should in a real biological system. More specifically, it was tough to achieve the distinct “on” and “off” switch. We initially looked at a single cell model and then implemented a two-cell system to explore the behavior of the cells if say, for example, one cell started with no internal signal and one started with 20 molecules. COPASI made it easy to explore the outcomes of shifting parameter values, such as diffusion between cells and initial concentrations of all necessary players. Brendan and I both plan to make this project into a thesis, so now we are figuring out what each of us will focus on specifically. Our model was based on *Escherichia Coli*, but Brendan is interested in exploring the dynamics for other species of bacteria. I am interested in potentially bringing the model up to four or eight cells, which are not all equidistant apart.



## ABSTRACT B3 – The Role of RNA-Binding Protein CPB-3 in Dendrite Morphogenesis in *C. elegans*

*Student Researcher* . . . . . Margaret Wolf  
*Co-Researchers* . . . . . Eugenia Olesnicky, Simona Antonacci, Kathrin Spendier  
*Faculty Advisor* . . . . . Darrell J. Killian, *Molecular Biology*

Neurons, or nerve cells, have specialized processes called dendrites that function to receive and integrate information from the environment or other cells. The development of branched dendritic trees is important for covering receptive fields and establishing neural connections. Many neurological diseases are caused by or are associated with defects in dendrites. For example, short dendritic spines are greatly reduced in patients with schizophrenia. Therefore, an understanding of the molecular mechanisms that govern dendrite morphology is critical to understanding the molecular etiology of neurological diseases. Evidence suggests that the morphology of dendrites is in part achieved through molecular mechanisms that generate asymmetric protein distributions within the cell. RNA-binding proteins (RBPs) are of particular interest because they are important for mRNA localization and translational control. Recently, several RBPs were shown to be important for dendrite morphogenesis in larval *Drosophila* (fruit fly) sensory neurons (Olesnicky et al., 2014). The vast majority of these RBP genes are evolutionarily conserved in animals including humans. To determine if RBP genes are conserved in their role in dendrite development across diverse animal species, we tested to see if loss of these RBP genes results in dendrite defects in *C. elegans* (worm) sensory neurons using the multidendritic PVD neuron as a model. During this genetic screen, we identified *cpb-3* as important for PVD dendrite morphology. Animals that lack *cpb-3* have a 33 percent reduction in the total number of dendrites. Furthermore, we show that loss of *cpb-3* also results in a cell-fate specification defect in roughly 20 percent of PVD neurons. *cpb-3* encodes a cytoplasmic polyadenylation binding protein, which suppresses mRNA translation into protein. We hypothesize that CPEB binds mRNAs and holds them translationally repressed during transport from the nucleus to the dendrites where they become active. Our finding that fluorescently labeled CPEB particles are transported within dendrites in living cells supports this hypothesis. We are currently using biochemistry methods to determine which mRNAs are bound and regulated by CPEB to determine dendrite morphology and therefore function.

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# Student Perspectives on Collaborative Research I: Concurrent Paper Sessions

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## Session C: Environmental Systems: Studying Localized Changes

### ABSTRACT C1 – **Micrometeorology and Tree Growth Dynamics at the Alpine Treeline on Pikes Peak**

*Student Researchers*. . . . . Emma Marshall, Dylan Sondermann, Rebecca Marks  
*Faculty Advisor*. . . . . Miro Kummel, *Environmental Program*

Thermal conditions determine the elevation to which alpine vegetation persists. Long-term historical data shows a correlation between periods of anomalously warm regional temperatures and advancement of the alpine treeline. On a localized scale, alpine vegetation are both heavily controlled by thermal conditions, and have the ability to influence their own microclimate. This duality instigates feedback between biota and surrounding air, the aggregate of which can dramatically shape alpine environments. Broadly speaking, this long-term study seeks to understand the mechanisms by which the alpine treeline is advancing up the northern slope of Pikes Peak. This specific installment focuses on the microclimatology of individual trees and stands of trees at various elevations within the Pikes Peak alpine zone. We used towers containing wind speed, temperature, and relative humidity sensors at various heights to measure micrometeorological conditions both in the open tundra and tree structures. This experimental design gave insight into air movement within the bubble created by trees as well as the obstruction trees pose to prevailing winds, which move upslope. Trees and stands of trees appear to support different microclimates within the structure of the tree. Leeward branches interrupt winds carrying cold, dry air, and in so doing, create a more favorable microclimate for growth on the leeward, upslope side of the tree.



### ABSTRACT C2 – **Climate and Chronology of the Last Glacial-Interglacial Transition, North-Central Great Basin, U.S.A.**

*Student Researcher* . . . . . Erica Evans  
*Faculty Advisor* . . . . . Eric Leonard, *Geology*

The Culebra Peak area of the southern Colorado Sangre de Cristo Range was extensively glaciated at the time of the Last Glacial Maximum (LGM), about 20,000 years ago. This project makes use of a 2-D coupled glacier energy/mass balance and flow model (Plummer and Phillips, 2003) to investigate the climatic conditions that could have sustained glaciers in the range at their LGM extents. Modern climate input to the model came from several sources, including PRISM climate grids, and SNOTEL and meteorological station data. The mass balance component of the model calculated annual snow accumulation and potential ice ablation across a 60m topographic grid of the study area, using a combination of these modern climate data and instructions on how to alter climate to try to simulate LGM conditions. The mass balance model output was then fed into the ice flow model to grow the glacier that would have developed in response to that climate input. The models were run iteratively until a good fit was found between the modeled glaciers and the actual mapped LGM ice extent. Model results indicate that, assuming no change from modern precipitation, a 5.3°C temperature depression compared to the present would have been necessary to sustain the paleoglaciers. A halving or double of LGM precipitation compared to the modern would have necessitated –8.1 and –4.3°C temperature depressions respectively.

This work was undertaken as part of a larger study that is making use of mapped glacial extents to characterize LGM climate along the crest of the Rocky Mountains from northern Montana to south-central New Mexico. Global climate models have suggested that during LGM the Pacific Northwest and northern Rockies were much drier than today but that, at least in the winter, precipitation was strongly enhanced in the Southwest and southern Rockies. Results from modeling in the Culebra Range, along with results of other modeling completed to date, corroborate these predicted patterns in LGM precipitation.

**ABSTRACT C3 – The Log Canoe: Oyster Farming on the Chesapeake Bay**

*Student Researcher* . . . . . Madelyn Santa  
*Faculty Advisor* . . . . . Mario Montaña, *Anthropology*

I approached the study of oyster farming from several perspectives. I did a field-based study for the summer, doing participant-observation, documenting the process of oyster farming through interviews, photography, and archival research. Currently, I am reading the intellectual history of material culture of maritime Chesapeake Bay, which covers anything created by people. However, my primary focus is the material culture associated with oyster farming. This entails documenting the production of oyster farming boats, nets, and the diversity of harvesting techniques. Furthermore, I intend to provide a historical-cultural ecology approach to oyster farming in this particular region. Eventually, I would like to understand the cultural changes associated with oyster farming and the way of life of oyster farmers. During my fieldwork, I collected oral histories, casual and formal interviews with the owner of the oyster farm and oyster workers, who are known as watermen. Now, I am in the process of managing my data and putting it into themes and topics that were highlighted by the people I was working with throughout this period. During this stage, I was able to analyze the different kinds of oyster farms and identify the principal material and social structures associated with the production of oyster farming. Then, I studied the historical changes associated with the structural modifications — the watermen, the oyster breeders, packing — of oyster farming. The next step is to do a cultural history of oyster farming as it pertains to the Chesapeake Region. This section will study the history of the Chesapeake cultural region, starting with the prehistory of this region to the present. I will write about the history of oyster farming, the eating of oysters, and the economic impact of oyster farming on this particular island, known as Hoopers Island. Originally the Native Americans would use log canoes for harvesting oysters. I would like to document the changes of the functions of farming and harvesting oysters. Finally, I will analyze oyster farming as a residual cultural object that has managed to survive through time and become imbued with different cultural meanings along the Chesapeake Bay.



"Sunset – Eastern Bay 7" by Nora Lives – (own work). Licensed under Creative Commons Attribution-Share Alike 3.0 via Wikimedia Commons – [http://commons.wikimedia.org/wiki/File:Sunset\\_-\\_Eastern\\_Bay\\_7.jpg#mediaviewer/File:Sunset\\_-\\_Eastern\\_Bay\\_7.jpg](http://commons.wikimedia.org/wiki/File:Sunset_-_Eastern_Bay_7.jpg#mediaviewer/File:Sunset_-_Eastern_Bay_7.jpg)



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## Student Perspectives on Collaborative Research II: Poster Presentations

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### Poster Session 1: Abstracts 10–23

#### 10. Demography and Habitat Selection by Flammulated Owls

*Student Researcher* . . . . . Jaclyn Silsby

*Co-Researchers*. . . . . Ellen Rigell, Mark Parlier

*Faculty Advisor*. . . . . Brian Linkhart, *Organismal Biology and Ecology*

This 34-year-long (and coming) research focuses on collecting demographical data on flammulated owls (*Psiloscops flammeolus*) in response to changes in the landscape such as forest fires, forest thinning, and climate change. This beautiful migratory species spends its breeding season in western North America during the summer months and travels to central Mexico for the winter. The information acquired over the summer is applied to numerous ecological concepts that contribute to a better understanding of flammulated owls themselves, to related raptor species, and to greater regional and global issues. The study takes place in the Manitou Experimental Forest of Woodland Park, Colo., and the surrounding area. Our crew work consists of daytime nest searching, fieldwork data entries, and vegetative quantification, with nights capturing/banding the owls. My individual responsibilities included banding, bleeding, and performing measurements on the owls, while also overseeing large study area data collection sets. Our goal this summer was to contribute significant demographical findings of flammulated owls which will add to prior data results compiled by Professor Linkhart. For example, with recent forest fire tragedies, the U.S. Forest Service is beginning to thin vegetation as an attempt to lessen the chances of higher severity fires. This summer, in our Trout Creek study area, we acquired the last pre-thinning data before the Forest Service begins thinning in 2015. Little is known about how forest thinning affects forest wildlife, so by using both pre- and post-demographic data on flammulated owls, we will be able to draw conclusions on its effects. Our accomplishments this summer: We banded 138 owls, caught 238, found 43 nests, and managed to place geolocators (migration tracking devices) on six; all of these were record numbers. Our summer findings exhibit a fraction of the work gathered over the many years of this research project, but are essential when planning for future results.



#### 11. Military Status Stereotypes: The Influence of Race, Gender, and Military Status on Perceptions of Warmth, Competence, Dominance, and Competition

*Student Researcher* . . . . . Melissa L. Barnes

*Faculty Advisor*. . . . . Emily Chan and Jason Weaver, *Psychology*

This summer, my advisors and I designed and completed two separate social psychological studies. The aim of the first study was to observe the effects of video stimuli on participants' perceptions of military veterans in general. The participants were required to watch one of four 30-second U.S. news reports that were randomly chosen for them. The topics of the report included U.S. military drones, a soldier receiving a medal of honor from the president, soldiers with PTSD, and the second Ft. Hood shooting. Participants answered items regarding warmth, competence, dominance, and competition of military veterans. The video stimuli did not affect participants' perceptions of military veterans on any of the four scales. The second study stemmed from the first project. Due to the lack of statistically significant findings in the first study, we decided to narrow our research scope. We decided to look at perceptions of a female depending on race and military status. Participants read a general description of a female, which was accompanied with a photo. In the written description, the character was described as an active-duty soldier, a retired soldier, or a civilian (no mention of military status). The picture of the character portrayed either a Black or Caucasian female, wearing either a military uniform or civilian clothes, while the veteran character was depicted in civilian clothes. The data for this study is currently being analyzed and final results will be available in late 2014. If statistically significant results are found in the current study, I will submit a poster abstract to a professional psychological association and hope to present this research at a conference in the near future.

## 12. A Three-Species Model with Predator-Prey, Competition, and Mutualistic Interactions

*Student Researcher* . . . . . Minqi Liu  
*Faculty Advisor* . . . . . Andrea Bruder, *Mathematics and Computer Science*

This research is inspired by Brown, Bruder, and Kummel's field research project on the interaction of aphids and ladybugs on yucca plants. An important feature of this study system is that it contains ants as a third species. Therefore, this ecological system is composed of a predator-prey relationship between the ladybugs and aphids, a competitive relationship between the ladybugs and ants, and a mutualistic relationship between the aphids and ants. Most existing mathematical models study one type of interaction, or they focus on three species and study a tri-trophic food chain. We develop and analyze a new mathematical model that includes the predator-prey interaction as well as the competitive and mutualistic aspects of the system. The predator-prey interaction is described by a Rosenzweig-MacArthur model, which assumes logistic growth of the predator. To build a mathematical model for the competitive and mutualistic relationships, we use a modified Lotka-Volterra model by adding terms representing competition and mutualism. Since the three-species model is substantially harder to analyze, we first study the three submodels, *i.e.*, the predator-prey, competition, and mutualism model. Then we use the submodel results to explore the three-species model and the significance of its parameter values. With the help of two computer programs, Mathematica and MATLAB, we construct phase planes and time series plots, find the equilibria of the systems, and determine the stability of each equilibrium.



## 13. How to Prevent Bullying: A Mathematical Approach

*Student Researcher* . . . . . Kaitlyn Martinez  
*Faculty Advisor* . . . . . Andrea Bruder, *Mathematics and Computer Science*

Bullying is known to result in significant psychological damage both in the victim and in the bully. But despite this reality, bullying research has hit a standstill in the last few decades, resulting in a lack of change and action towards the prevention of this destructive phenomenon. Bullying spreads through a susceptible population not unlike an infectious disease. We use methods from epidemiology to study the dynamics of a bullying “epidemic.” In our compartmental differential equation model, we introduce one bully into a population of susceptible individuals. Once the susceptible individual is exposed to a bully, they become “infected” and then they can either become a bully themselves, or not. From each of those stages the individual can recover and then be reintroduced into the susceptible population. Then we perform parameter analysis and find the reproductive rate,  $R_0$ , which is the number of secondary infections that stem from a primary case. Then we introduce an intervention model that can be altered to reflect interventions that schools today use to respond to bullying. Using the intervention model, we are able to show that the method most commonly used to prevent bullying, the Traditional Disciplinary Approach — an approach that focuses solely on assigning responsibility to the bully and on instigating change of behavior via punishment — has the least amount of impact on the population affected by bullying.



## 14. Subtitling of ‘La Vecchia Guardia’

*Student Researchers* . . . Grace Hunter, Joanna Lingenfelter, Sophie Tirado  
*Co-Researcher* . . . . . Erik Scaltriti  
*Faculty Advisor* . . . . . Andrea Righi, *French, Italian, and Arabic*

This summer, Grace Hunter, Joanna Lingenfelter, and Sophie Tirado wrote English and Italian subtitles to Alessandro Blasetti's film “*La Vecchia Guardia*.” The film is a notable piece of fascist propaganda, depicting a fascist perspective of Italian politics right before the March on Rome. To complete this project, we transcribed the movie in Italian, translated the Italian transcription into English, timed the subtitles to match the dialogue of the movie, edited the Italian transcription and timings of the English subtitles to create Italian subtitles, produced a trailer of the film, and created a DVD with our subtitle tracks. While working on this project, we learned to appreciate the work that goes into producing subtitling tracks and the difficulties of producing “accurate” translations.

## 15. Synthesis and Spectroscopic Analysis of Spin-Crossover Cobalt Complexes

*Student Researcher* . . . . . Henry Zecca  
*Co-Researcher* . . . . . Hannah Kim  
*Faculty Advisor* . . . . . Amanda Bowman, *Chemistry and Biochemistry*

Spin crossover is a transition from a ground state to an excited state, commonly low spin to high spin, seen in metal compounds. These transitions are easily controlled using heat or pressure and may also cause a change in color, which allows the transition to be easily monitored. Because these complexes have two easily controlled discreet states, they can be used as effective molecular switches and a medium for data storage. Spin crossover behavior is commonly seen in Fe(II) and Fe(III) compounds, however similar behavior also occurs in cobalt compounds. The goal of the project was to synthesize a family of tridentate bis-iminopyridine (BIPY) based ligands and then characterize their cobalt complexes. While we were able to synthesize the ligands, the complexes proved to be air sensitive and degraded rapidly. We plan to continue the research after we have the ability to carry out air-free reactions. The methods used for characterization of ligands included IR and NMR spectroscopy, while characterization of the planned complexes will be performed using UV-Vis, X-ray crystallography, and measurement of magnetic susceptibility. A Fisher esterification of pyridine-2,6-dicarboxylic acid produced the diethyl ester from which the diacetyl was formed with high yield. Treating the diacetyl with RNH<sub>2</sub> (where R=cyclohexyl, n-hexyl, phenyl, isopropyl, tert-butyl) produced the desired family of bis-iminopyridine compounds.

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## 16. Synthesis of Fluorinated Antimalarial Analogs

*Student Researcher* . . . . . Jackson Roos  
*Faculty Advisor* . . . . . Habiba Vaghoo, *Chemistry and Biochemistry*

Malaria is an infectious disease caused by protozoan parasites of the genus *plasmodium* and transmitted by the female anopheles mosquito. While it is not much of a threat to most western countries, it is one of the leading killers in developing countries. One third of the world is subject to contracting the malaria parasite, and each year, approximately one million people are killed by the resulting disease. There are a handful of effective anti-malarial drugs, but resistance is growing and new drug development is needed. Amodiaquine has been shown to be a potentially useful anti-malarial agent but its use is limited. This is due to the presence of the 4-amino phenol functionality that is easily metabolized to produce highly reactive and toxic byproducts (quinine imines) that cause harmful and potentially lethal side effects. Replacement of the alcohol (OH) functionality to one that cannot be oxidized is thus desirable. We hypothesize that substitution of OH by CF<sub>2</sub>H should eliminate in vivo oxidation to toxic metabolites, thereby eliminating the dangerous side effects. Herein, we propose a seven-step synthetic route for the new series of fluorinated analogs and the progress we have made thus far. Four of the seven steps have been successfully completed and work is ongoing to optimize the fifth and sixth step. Preliminary data indicates that the steps are feasible but require further optimization. The last step (seventh) involves the key fluorination step that will introduce the CF<sub>2</sub>H in the para position (to the amine). Once these analogs are synthesized they will be assayed for anti-malarial activity.



## 17. Development and Reliability Testing of the Colorado College Anaerobic Capacity Test (CAT)

*Student Researchers . . . . .* Kaeli Vandersluis, Rachel Herron  
*Faculty Advisor . . . . .* Anthony Bull, *Human Biology and Kinesiology*

Field-based sports such as soccer involve repeated high intensity, short duration sprints which rely on a high rate of cellular ATP production and a large anaerobic capacity to do work. Various field tests are used by coaches to assess anaerobic fitness; however, many tests do not provide a quantifiable estimate of anaerobic capacity. Therefore, the purpose of this study was to develop a field test for anaerobic capacity that would be easy to administer, provide reliable results with field-based athletes, and provide coaches with useful information about athletes' anaerobic fitness. The Colorado College Anaerobic Capacity Test (CAT) was developed after multiple testing sessions of various protocols with local soccer athletes serving as participants. In its final version the CAT consists of repeated 40-meter sprints (the width of the penalty box on a standard soccer field) at maximal speed. Athletes have seven seconds to run the 40 meters, with 13 seconds of active recovery in between sprints. Athletes continue sprints every 20 seconds until they can no longer cover the 40 meters in seven seconds, and their number of attempted sprints is recorded. The Colorado College Women's Soccer team performed the CAT twice within a seven-day period to evaluate the test's reliability, with 14 athletes completing both trials. The mean (SD) number of sprints attempted by the athletes in the two CAT trials was 8.0 (2.8) and 7.14 (3.0), respectively. A dependent t-test revealed that there was a significant difference ( $n=14$ ,  $p=0.012$ ) between the mean sprints completed in the two trials, indicating that this test was not reliable. However, this poor reliability may be due to the fact that the soccer team had a practice on the morning that the second test was administered, but not the first. This unexpected hard effort could have affected the results in the second trial because the athletes were fatigued from a high-intensity practice. Continued testing is planned to evaluate the reliability and validity of the CAT with more subjects and with greater control over the amount of exercise done 24 hours prior to administering the test.

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## 18. The Politics of Homophobia in Post-Communist Russia

*Student Researcher . . . . .* Arina Abbott  
*Faculty Advisor . . . . .* John Gould, *Political Science*

This research demonstrates the rise, fall, and revival of the Russian LGBTQ movement, but also the overarching political disenfranchisement of its activists. While Gorbachev's *glasnost* and the dissolution of the Soviet Union opened the door for LGBTQ activism, the political movement failed to take hold. A focus on social life came to dominate until Nikolai Alekseev, a law student, became involved in LGBTQ activism after his research thesis concerning the "Legal Status of Sexual Minorities" was rejected by his Ph.D. program at Moscow State University. Alekseev's approach to LGBTQ activism via gay pride parades and assertive legal tactics has revived the LGBTQ political movement and contributed to the creation of other activist organizations. This re-politicized movement and its constituency are faced with serious social and political threats. This narrative becomes more complex within the context of Russian political evolution. The Russian decriminalization of sodomy in 1993 was not the result of the LGBTQ movement's political efforts. Rather, it was perhaps a result of the Russian political and legal elite's decision making, explicit or implicit Western pressure as Russia sought to join the Council of Europe, or some combination of the two. Nonetheless, it was not a result of a politicized LGBTQ movement and consequently did not have broad-based social implications. Since decriminalization, homophobic attitudes and political rhetoric have persisted, skinhead culture and right-wing politics have risen, and numerous forms of anti-LGBTQ legislation have been actively promoted. Most insidiously, the Kremlin has come to adopt an explicitly anti-gay line following the June 2013 federal ban on "propaganda of nontraditional sexual relations among minors" as a part of President Vladimir Putin's increasingly traditionalist, socially conservative, and nationalist rhetoric. As Putin's government continues to crack down on Russian civil society and defiantly turns away from the West, the revived LGBTQ activist organizations and the minorities they protect face greater danger.



## 19. Chilean Post-Dictatorship Memory in the Present

*Student Researcher* . . . . . Tessa Allen de Oliveira  
*Faculty Advisor* . . . . . Andreea Marinescu, *Spanish*

On September 11, 1973, Chile's armed forces overthrew Salvador Allende's Popular Unity government in a violent *coup d'état*. General Augusto Pinochet's brutal dictatorship resulted in 5,000 deaths, 40,000 political refugees, and 10,000 cited torture cases. Many others "disappeared." The 1988 Referendum inaugurated a "return to democracy," although Pinochet remained head of the armed forces until 1998. He was indicted for human rights violations but was never brought to trial. Lacking any sort of emotional closure and virtually abandoned by democratic legal institutions, Chileans are still grappling with ways to represent a traumatic past in the problematic present. Chile's still-liminal state between trauma and transition inspired our research topic: Traumatic memory in the digital age. We focused on the following question: How have spaces of memory transformed trauma and inserted themselves into contemporary politics? We tracked the digital presence of several spaces of memory in Santiago, Chile, through Facebook and their official websites, logging posts and URLs from Londres 38, Villa Grimaldi, and The Museum of Memory and Human Rights. We focused on digital information relating to contemporary social issues to discover how each space maintains a connection to both pre- and post-dictatorship events. The Museum is a government-run organization, and its digital presence reflects that: Its discourse is conservative, official, and mediated. It does not allow back-and-forth communications through "comments" or "posts." Villa Grimaldi, the most widely known ex-detention center, has a minimal digital presence. Only the official "*Villa Grimaldi*" can post on the Facebook page, and all links redirect to their website. Conversely, Londres 38 — another ex-detention center established and run by friends and family members of previous detainees — offers an interactive, community-based digital space in which anyone can post, share stories, agree, disagree, *etc.* The three spaces are working to expand and digitalize historical archives (many of which are still held by the government). These spaces have inserted themselves into contemporary politics by exposing issues of women's rights, indigenous rights, and the price and accessibility of higher education. Digital space allows for past and present injustices to become a continuous transnational story in which organizations and individuals insert themselves to reshape an ongoing, problematic discourse.



## 20. Historical Dictionary of Chile

*Student Researcher* . . . . . Katia Allen de Oliveira  
*Faculty Advisor* . . . . . Salvatore Bizzarro, *Spanish*

Much has transpired in Chile since the first edition of the first in the series of *Historical Dictionaries of the Americas* was published in 1972. Most significant was the *coup d'état* that toppled the first Marxist government elected in South America, that of Salvador Allende (1970–1973), and the fact that 30 years later, with a return to democratic rule, ironically Chile elected another Socialist, Ricardo Lagos (2000–2006), to be president. The second and the third editions focused mainly on the 17-year dictatorship of Augusto Pinochet (1973–1990), and the reign of terror that followed the death of Allende and of democracy. The fourth edition concentrates on the transition to democratic rule and the coalition of parties of the Left primarily, and then the Right, that governed Chile since the end of authoritarian rule. The fourth edition is a reference work, much like the previous three, and spans more than a thousand pages, annotating entries that focus on Chilean institutions, places, political events, relationships with other countries of the Western hemisphere, the European Union, and the rest of the world, as well as on the dynamics that make up life and culture in Chile and the rest of Latin America. I primarily researched the following topics: updating the chronology of events from 2005 to the present, updating population statistics, creating a map of the provinces of Chile with the addition of two new regions, biographical information on the cabinets of the four Chilean presidents that have succeeded Pinochet, the formation of new political parties since the dictatorship, the price of mineral commodities, and the student movements of the previous ten years.

## 21. Type IV Pilus Proteins of *Acinetobacter Baylyi*: Measuring Competence Quantitatively with Puddle Transformation

*Student Researcher* . . . . . Colleen Leong  
*Co-Researchers*. . . . . Rebecca Bloomfield, Caroline Boyd, Flora Liu, Kaleb Roush  
*Faculty Advisor*. . . . . Phoebe Lostroh, *Molecular Biology*

*Acinetobacter baylyi* are naturally competent soil bacteria — the organism possesses an innate ability to import extracellular DNA (both native and foreign) from its environment using the Type IV pilus competence machine. Mutants of *A. baylyi* were obtained from a French laboratory and mutations (marked by a kanamycin-resistant region; ACIADxxx::kan-tdk) were transformed into a fresh ADP1/BD413 (wild type) background to ensure competence. Mutants lacked strategic genes postulated to be important in the building of the pilus, uptake of DNA, motility (*i.e.*, twitching), *etc.* Puddle transformation with streptomycin-resistant DNA allowed for researchers to determine quantitative transformation efficiency and therefore which genes were necessary for competence. Research conducted during summer and fall 2014 produced findings regarding genes required for the uptake of DNA. Keywords: *Acinetobacter baylyi*, Type IV pilus, competence, transformation

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## 22. Surface Protein Isolation of *Acinetobacter Baylyi* in Relation to Natural Competence and Twitching Motility

*Student Researchers* . . . . . Flora Liu, Colleen Leong, Rebecca Bloomfield  
*Faculty Advisor* . . . . . Phoebe Lostroh, *Molecular Biology*

*Acinetobacter baylyi* is a bacterium with extracellular appendages responsible for natural competence and twitching motility. The molecular makeup of the competence and twitching machineries are very similar; they share many of the same proteins and have similar structures. To understand the appendages on the molecular level in relation to natural competence and twitching motility, surface proteins were isolated from wild type cells and single-gene deletion mutants. Cells were obtained from 0.5% soft agar incubated at 37°C for 18 hours at approximately 70% humidity. Furthermore, to explore the expression of twitching appendages in relation to natural competence, DNA and DNase were added to cell culture before incubation. To isolate surface proteins, cells were scrapped off into a PBS, NaCl, and β-mercaptoethanol solution with heat and physical force applied in different intervals. Surface proteins expressed by different cells were compared using 10–20% gel electrophoresis, and visualized under the UV light with fluorescent dye. The results from the gel showed single-gene deletion mutants under-express many proteins. A correlation is seen between the amounts of surface protein expressed and the ability to be naturally competent and twitch: when competence or twitching compromised, the surface proteins of the mutants are also under-expressed. Under the addition of DNA and DNase to wild type cells, the surface protein expression also decreased. This research is the first molecular study of the expression of surface protein in *A. baylyi*, and with further experimentations including lyophilization will help to find more specific correlation between expression of particular surface proteins and natural competence and twitching motility.



### 23. Morphological Changes of *Acinetobacter Baylyi* Over a Growth Curve

*Student Researcher* . . . . . Caroline Boyd, Kaleb Roush  
*Co-Researcher*. . . . . Nick Lammers  
*Faculty Advisor* . . . . Phoebe Lostroh, *Molecular Biology* and Kristine Lang, *Physics*

*Acinetobacter baylyi* is a gram-negative soil dwelling bacterium that has traditionally been studied using light microscopy. However, we use atomic force microscopy (AFM) that has a resolution of approximately 2–10 nanometers, which is substantially superior to the 200-nanometer resolution of light microscopy. AFM also generates 3D images which high-resolution electron microscopy cannot do. With tools provided by Nanoscope Analysis, a computer program for evaluating images captured with AFM, we can measure features of the *A. baylyi* cells with extremely high precision. Combining this morphological data with our growth curves, we created an extensive, nanoscale detailing of *Acinetobacter baylyi*'s growth patterns over exponential and stationary growth phases. For two hours we grew *A. baylyi* in LB broth at 37 C with shaking. To ensure that we captured the cell growth through exponential and stationary phase, we sampled the broth every hour for twelve hours. Each sampling required pelleting, washing in distilled, deionized water, plating onto an atomically flat surface of cleaved mica, and allowing the cells to dry for a minimum of 18 hours. Next we utilized the AFM and captured three-dimensional images, which we subsequently analyzed using Nanoscope Analysis. We have found significant variations in the morphology and morphological diversity that correspond with the changing slopes of the growth curves. Certain time points have a higher percentage of a certain morphology that then shifts into a new form, generally found in the next one or two time points. Additionally, we discovered surface features that are artifacts of drying the cells that most likely indicate where the chromosomes/nuclei are within a cell.

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## Student Perspectives on Collaborative Research II: Poster Presentations

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### Poster Session 2: Abstracts 24–38

### 24. Reviving African Sleeping Sickness Research

*Student Researchers* . . . . . Galina Parfenov, Jarod Rutledge  
*Co-Researcher* . . . . . Min Kim  
*Faculty Advisor* . . . . . Amy Dounay, *Chemistry and Biochemistry*

Human African Trypanosomiasis (HAT), more commonly known as African sleeping sickness, is a parasitic disease endemic to a significant part of western, central, and eastern Africa. The disease is considered a Neglected Tropical Disease (NTD): although it kills over 10,000 people per year and impacts countless more livelihoods, it garners little funding and attention from the pharmaceutical industry. Our HAT research program is a response to the inadequacy of current treatments and research. We aim to discover and develop new drug leads and clinical candidates for combating HAT using medicinal chemistry techniques. Based on previous work, our lab has developed a synthetic route for the construction of a novel series of hydroxamic acids. Our new compounds will be assayed to test a hypothesis for the mechanism of anti-trypanosomal activity exhibited by a recently developed clinical candidate drug known as SCYX-7158. This summer, building on the efforts of students in previous years, we were able to complete the entire proposed synthesis and submit several hydroxamic acid analogs for further analysis by LC/MS/MS. An 8-step synthesis was used to prepare hydroxamic acid analogs from commercially-available 4-fluoro-3-nitroaniline. Ongoing studies are focused on purification of analogues in preparation for parasite toxicity assays and cytotoxicity studies. Iterative cycles of compound synthesis and optimization will lead to the development of a preclinical candidate.

## 25. An Investigation of Greenhouse Food Production in The IvyWild Symbiotic District Zone

*Student Researchers* . . . . . Julian Kraus-Polk, Miles McCreary  
*Faculty Advisor* . . . . . Marie Davis-Green, *Theater and Dance*

The “symbiotic district model” implemented at the IvyWild School is an example of businesses that have established commerce relations and byproduct exchange that contribute to social, ecological, and economic benefit. This paper systematically assesses both existing and potential byproduct exchange at the IvyWild School, in hopes to maximize these multi-benefit connections. The specific focus of the paper is to evaluate the potential for a greenhouse-growing space to increase onsite resource cycling. A systematic approach was used to quantify and qualify all the byproducts generated from the various businesses at IvyWild. Using initial investment and cost recovery projections we were able to posit payback times for certain waste recovery systems. Secondly, through interviews and site visits we generated and juxtaposed six greenhouse profiles. This provided examples of design and management strategies for greenhouses on the Front Range that might inform IvyWild School greenhouse. The results show that the capture and exchange of CO<sub>2</sub> and wastewater by-products at IvyWild School have significant economic and ecological benefits. Alone, these potential by-product exchanges do not form an economic justification for building a greenhouse. However, it is clear that incorporating a greenhouse would allow for further resource cycling with tangible ecological and social benefits associated. Our recommendation is to build a passive solar greenhouse in order to increase resource cycling onsite. This greenhouse would allow for IvyWild to act as a hub for education about regional and small-scale food production, exemplify innovative systems of resource efficiency, and build a more resilient and connected community.



## 26. Critical Edition of ‘Rhapsody in Blue’

*Student Researcher* . . . . . Connor Rice  
*Faculty Advisor* . . . . . Ryan Bañagale, *Music*



This summer, Professor Bañagale and I began working on a new critical edition of the George Gershwin composition “Rhapsody in Blue.” The process involved creating a digital representation of the piece from original source materials, including the score that Gershwin originally created. A secondary result of this work was the creation of software that is designed to aid in the production of a modern critical edition. This software, Critical Tools, is aimed at giving editors of musical critical editions more efficient ways to compare their digital representations of musical works to their original source materials. This collaborative grant allowed student researcher Connor Rice to apply his background as a double major in music and computer science. The score that was produced this summer was created in Finale 2014, which is the industry standard for music notation. The software, Critical Tools, was written in Java. Finale and Java are taught by the Music and Computer Science Departments at Colorado College, and were highly important to the results of this collaborative grant. In the end, we were able to produce an early version of the edition software, and a very detailed representation of the jazz band arrangement of “Rhapsody in Blue.” While neither of the projects were completely finished, the score that was created represents over 23,000 notes, and the software will provide a basis for the thesis work of the student researcher.



## 27. A Comprehensive Look at Professional Music Composition and Production

*Student Researcher* . . . . . Andrew Randall  
*Faculty Advisor* . . . . . Ofer Ben-Amots, *Music*

This summer, Professor Ben-Amots and I engaged in a collaborative project encompassing several aspects of being a professional composer from the creativity of composing to the pragmatism required to run one's own business. One of our biggest tasks was researching and implementing techniques for expanding a composer's visibility on the Internet. I learned 'wikicode' — the language used for creating Wikipedia articles — to both author original articles and create links from other pages to Ofer's page. Our other major task was to create a comprehensive database of Ofer's published compositions. This process involved confirming and assigning the appropriate ISBN number to each piece, creating catalogue numbers, formatting compositions to fit hard publication requirements and updating the digital files and records for each piece. By the end of the summer, we had a complete and up-to-date spreadsheet with notes on where further editing is required. I also learned how to operate a CD press, format cover art, and print both CDs and DVDs. On the creative side, I began expanding a piece Ofer had composed for one voice to a piece for four voices. Though I was not able to complete the arrangement, the exercise offered insight into how creative work that already exists can be manipulated into new and unique compositions. Our project offered a comprehensive look at all of the elements required to be a composer on the professional level. I look forward to implementing the skills I gained during our summer research as I embark on my own composition for my Senior Capstone Project.



## 28. An Exploration of Music through Time: Asian Maritime Circuits, the Bruno Nettl *Festschrift*, and Liberal Arts Curricula

*Student Researcher* . . . . . Emily Kohut  
*Faculty Advisor* . . . . . Victoria Lindsay Levine, *Music*

This summer's research has proved to be experiential, a glimpse into the academic world, a world I hope to enter in the future. I have been involved in a variety of projects that required a variety of skills and have learned more than I would have ever imagined. Researching for Vicki Levine this summer has included Powerpoint making, library runs, pre-reading books and articles, online research, and a lot of formatting. Vicki is currently co-editing a book that will be called "This Thing Called Music: Essays in Honor of Bruno Nettl." For this book, I have been assisting Vicki in formatting the chapters: *i.e.*, making sure all chapters are formatted and helping her to keep track of different logs necessary for the process as the publisher specifies before it can be submitted. I have also helped prepare a presentation: Doing bibliographic research, creating Powerpoints, *etc.*, for the "Picturing Commerce: Visual Forms in Motion in and from the Asian Maritime Circuits, 1550–1800" symposium that was hosted here at CC this summer. I attended the symposium and worked with the scholars throughout the course of that weekend. The final project we have been working on throughout the course of this summer is researching music departments at 15 liberal arts schools across the country. This study focuses on size of the departments, major requirements, courses offered, focuses of professorial staff, *etc.* We have created a survey to be given to staff and Vicki will be doing phone interviews with department heads at these institutions. The goal of these interviews and surveys is to see more specifically what each institution values and where their focuses lie within the music department. With this research, Vicki and I will co-author a paper that will be presented at a conference this November, and the paper will later be expanded and become a chapter in a book. This summer's research has exposed me to so many different facets of the academic realm and has encouraged me to continue exploring academic life after college.

## 29. Summer Music Festival Alumni Research

*Student Researcher* . . . . . Daniel Sponseller  
*Faculty Advisor* . . . . . Michael Grace, *Music*

This summer, my project dealt with the Colorado College Summer Music Festival. For the month of June, I was the student assistant for the festival. My duties were mainly in setting up various locations for concerts, both on and off campus. I also wrote program notes for some of the Music Festival concerts throughout the month. In July, I put together contact information on the many alumni of the Summer Music Festival, with the ultimate goal of creating a master list of contact information for each student along with information on where their careers have taken them.



## 30. Alpine Shrub Advancement and Tree Growth Facilitation on Pikes Peak

*Student Researchers*. . . . . Audrey Wheeler, Alexandra Drew  
*Faculty Advisor* . . . . . Miro Kummel, *Environmental Program*

In alpine tundra zones worldwide, fragile ecosystems are being affected by regional temperature increases resulting from global climate change. Researchers have determined in many areas that warmer average temperatures and longer growing seasons are allowing trees to grow at higher elevations, causing localized trends of treeline advancement. On Pikes Peak, Colorado, treeline has advanced 18m in elevation and 60m surface migration from 1953–2009. We investigated whether shrubs on Pikes Peak have also begun growing at higher elevations as a result of the same regional temperature increase that affected treeline. Additionally, in order to learn about tree-shrub relationships and how shrub advancement may affect treeline, we examined how the shrubs may be facilitating or competing with isolated trees above treeline. Our first goal was to compare the ages of alpine shrubs (two *Salix* species) with their elevations in the Beaver Creek Valley at ~12,000ft HAE on Pikes Peak. We collected age and elevation of shrubs along four transects up the east-facing side of valley and one long transect following the streambed up the valley floor. Regarding our second question of how shrubs are affecting Engelmann Spruce (*Picea engelmannii*) at an altitude above treeline, we measured temperature, relative humidity, height, and growth for trees above treeline. The comparison between age and elevation of shrubs does not suggest an obvious of a trend of advancement, like that of the treeline. However, whether or not advancement is happening, shrub presence may be facilitating trees to grow above treeline. Tree height and growth data suggest that isolated trees above treeline grew more in the last growing season in areas where shrubs are present. Microclimate data within shrubs and trees showed temperature and relative humidity fluctuating more at points outside of trees and shrubs, less inside shrubs, and least within trees. From our results, we can conclude that the shrubs are not advancing in clear patterns in the Beaver Creek Valley, though there may be less obvious trends of increasing shrub density or non-uniform advancement. There is some shrub facilitation of trees based on temperature in which shrubs may be providing spruce seedlings with a modified microclimate that provides shelter from the extreme weather events that are common at this altitude.



"Crystal Creek Reservoir 1" by Fredlyfish4 – own work. Licensed under Creative Commons Attribution-Share Alike 3.0 via Wikimedia Commons – [http://commons.wikimedia.org/wiki/File:Crystal\\_Creek\\_Reservoir\\_1.JPG#mediaviewer/File:Crystal\\_Creek\\_Reservoir\\_1.JPG](http://commons.wikimedia.org/wiki/File:Crystal_Creek_Reservoir_1.JPG#mediaviewer/File:Crystal_Creek_Reservoir_1.JPG)

### 31. Assessment of Acid Mine Phytoremediation of the Kerber Creek Watershed

*Student Researcher* . . . . . Erika Berglund  
*Co-Researcher* . . . . . Gabriela Rodriguez  
*Faculty Advisor* . . . . . Mari Lee and Darren Ceckanowicz, *Environmental Program*

This study examines various plant species established in sites that have been remediated after acid mine deposition along the Kerber Creek Watershed. This watershed runs through Bonanza Mining District, where several mining operations took place from the 1880's to 1970's resulting in about 200 acres of abandoned mine tailings. These tailings caused large-scale soil acidification and leaching of toxic heavy metals. Trout Unlimited, a national conservation organization, and other non-profits spent several years working to remediate the watershed by way of adding lime and compost to soil, erosion control, and planting resilient plant species. Phytoremediation, or the use of plants and their microorganisms to reduce contamination, is a cost-effective, relatively easy, and natural way to remove toxic heavy metals from soils and waters. In order to understand the effectiveness of phytoremediation efforts in the Kerber Creek watershed, several plant samples were taken from 10 treated sites, one control site, and one untreated (but contaminated) site. Each plant sample was divided into roots, shoots, and leaves and dried. Samples were acid digested, filtered, and sent through an Inductively Coupled Plasma instrument to determine metal content. These metal concentration results were corrected for contamination and compared in several different ways including across sites, across species, and within species. A couple of the sites had significantly higher concentrations in all metals across all species. In general, all of the species had the highest concentration of metals in the root system, as opposed to the shoots or leaves, but some species tended to translocate to aboveground tissues more than others. Compared to metal concentration data from leachable soil content from the same sites, the plant samples contained significantly higher concentrations particularly in Iron (Fe), Zinc (Zn), and Copper (Cu). These results will continue to be studied and eventually reported back to Trout Unlimited to inform their phytoremediation work.



### 32. The Use of Recombinant DNA Techniques in Determining Gene Expression

*Student Researcher* . . . . . Julia Barney  
*Co-Researchers* . . . . . Simona Antonacci, Margaret Wolf, Courtney Tyus  
*Faculty Advisor* . . . . . Darrell J. Killian, *Molecular Biology*

DNA, the genetic material of living organisms, is a specialized polymer which encodes for the proteins used in a cell. Promoter sequences are responsible for controlling expression of protein-coding genes. In multicellular organisms, different promoters may be active or inactive depending on the cell type. When the location of expression for a specific gene is unknown, scientists use recombination techniques to fuse the promoter sequence with a reporter gene. A widely used reporter gene is Green Fluorescence Protein (GFP), which comes from jellyfish. GFP is useful because it can be easily visualized using fluorescent microscopy. When the native promoter of a gene is fused with GFP, green fluorescence is visible in cells where the promoter is active, and thus where the gene is naturally expressed. Once the general location of expression is known, a more specific subcellular localization of the protein can be determined using a cDNA::GFP fusion. In a cDNA fusion, expression of the protein can be driven by a non-native promoter to increase expression or restrict it to a specific cell type. In neurons, a class of proteins known as RNA binding proteins (RBPs) have been shown to play a role in dendrite morphogenesis. Several genes in the *C. elegans* genome encode for RBPs, so it is important to understand which of those genes are expressed in neurons. More specifically we are interested in whether (and how) each RBP gene is expressed in the PVD neuron. To answer that question, we turn to the DNA recombination techniques of promoter::GFP fusion and cDNA::GFP fusion. We test the native promoter for each gene using the promoter::GFP fusion to determine if the gene is expressed in the PVD neuron. For each gene that does show expression in the PVD, we use the cDNA::GFP fusion and a neuron-restricted promoter to determine where in the PVD the protein is localized. This localization is important to understanding the role of each RBP in the cell and how it contributes to the dendritic phenotype. Through this process, we have identified several RBPs which affect the dendrite morphogenesis in the PVD.

### 33. The Role of RNA-Binding Protein SUP-26 in Dendrite Morphogenesis in *C. elegans*

*Student Researcher* . . . . . Courtney Tyus  
*Co-Researchers* . . . . . Simona Antonacci, Eugenia Olesnicki  
*Faculty Advisor* . . . . . Darrell J. Killian, *Molecular Biology*

A neuron is a specialized cell that transmits nerve impulses. Dendrites are cellular processes that receive signals from other cells or the environment. It's important to understand how dendrites form because many neurological diseases show atypical dendritic morphologies. For example, compared to a normal neuron, people with autism have decreased dendritic branching with increased dendritic spines. Thus, if we can understand the mechanisms behind neuron morphology, we will be able to better understand these diseases. In order to investigate dendrite morphogenesis RNA-binding proteins (RBPs) are of particular interest because they regulate mRNA localization and translational control. We hypothesize that the nucleus is constantly transcribing genes necessary for dendrite growth and that RBPs localize the transcribed mRNAs to dendrites where they regulate their translation into proteins. Thus, when a dendrite receives a signal to grow, the protein can be quickly made locally within a dendrite and the neuron can respond immediately. Using the worm, *C. elegans*, as a model organism we have conducted genetic screen to identify evolutionarily conserved RBPs that are important for dendrite development in the multidendritic PVD sensory neuron. Among several genes we identified as important for dendrite development, here we focus on sup-26. Using four different mutant alleles we show that loss of sup-26 activity results in a significant dendrite reduction in PVD neurons. A study of dendrite development over time indicates that sup-26 mutants have a dendrite maintenance defect and the reduction in dendrites is partly due to loss of dendrites rather than failure to initially form them. This is interesting because neurological diseases, such as Alzheimer disease, are associated with dendrite loss over time. To better understand how the SUP-26 RBP regulates dendrite development we fluorescently labeled the protein and found that it is localized to perinuclear granules within the PVD neuron. This is consistent with a role of post-transcriptional mRNA regulation in the cytoplasm.

### 34. Entrepreneurship

*Student Researcher* . . . . . Chuin Chieh Ong  
*Faculty Advisor* . . . . . Daniel Johnson, *Economics and Business*



The purpose of this summer research was to investigate the existence of significant differences ranging from cognitive style, varying degrees of propensity for cognitive bias, inherent characteristics and personality traits that distinguished entrepreneurs from the general population, and for discriminating between successful entrepreneurs and non-successful entrepreneurs. In recent decades of technological advancement, Entrepreneurship has established itself as a subject that is increasingly researched with hopes that the findings will provide more explanation towards understanding the way in which a multitude of opportunities are evaluated as well as exploited by ambitious individuals all over the world; and yet the very researchers in this field of research have failed and continued to struggle with finding an overarching definition. Without a singular definition of what entrepreneurship is, much of the research that has been completed previously is problematic in how it forces researchers in the field to “talk after one another,” as opposed to “talking to one another” in a figurative sense. There are a whole variety of other factors that contribute towards our understanding of entrepreneurs as a whole. Those listed above are only the very brief and concise versions of notes taken throughout the progress of this research and it is expected that this research will continue under the careful advisory of Daniel Johnson.





### 35. The Phylogenetic Analysis of Orchid Genus *Pluerothallis*

Presenter . . . . . Michelle Cully  
Faculty Advisor . . . . . Mark Wilson, *Organismal Biology and Ecology*

The main focus of my research was analyzing the phylogenetics, or evolutionary relationships, of the species in the orchid genus *Pluerothallis*. In order to determine the evolutionary relationships between *Pluerothallis* species, two sections of DNA had to be sequenced. The first sequence of interest was the nuclear internally transcribed spacer (nrITS) which is, as the name suggests, a part of nuclear genome. The second sequence of interest was matK, a gene located in the chloroplast genome of plants. Both sequences are found in every plant. The sequences are known to be regions of high variability. This was very important since the species being compared were extremely similar genetically. Sequencing these strands of DNA was what I labored over most of time in lab. The process first required the extraction of DNA from the leaf of a plant. Then PCR was used to amplify the sequences of interest. Afterwards the PCR product had to be purified before samples could be sent to a sequencing lab. Once the raw data was received from the sequencing lab the sequences needed to be aligned before they were ready to be analyzed. Finally the sequences could be incorporated into the analytical software that produced the evolutionary trees. The software used a method of maximum parsimony to determine the evolutionary relationships and boot strap values. The higher a boot strap value the more supported or accurate the relationships were on the tree. The reason why the evolutionary data was important was because it suggested the relationships of these plants based off of genetics and not simply anatomy. As of right now the current taxonomy of *Pluerothallis* has only been based off of morphology. The data I attained from these trees suggested three important findings. First, data suggests that *Acronia*, a genus of orchids should actually be a sub-genus (*Acroniae*) of *Pluerothallis*. Second, all of the species that are part of the sub-genus *Acroniae* should not be divided into three distinct groups. Finally, another sub-genus of *Pluerothallis*, *Macrophyllae-Fasciculatae*, should not be incorporated into the sub-genus *Acroniae* but remain its own separate sub-genus.



### 36. What do you do when the man that you are isn't the man that you want to be? Black Homosexuality and the Black Church on FX's *The Shield*

Student Researcher . . . . . Kadesha Caradine  
Faculty Advisor . . . . . Heidi R. Lewis, *Feminist and Gender Studies*

Over the summer, I collected and reviewed primary and secondary sources. This entailed effectively and efficiently engaging sources (books and scholarly journals, particularly) by reading them and taking notes, assessing their effectiveness and credibility, and providing this research summary to Professor Heidi R. Lewis. I will also assist with presenting a version of Professor Lewis's article at the Block 2 feminist and gender studies scholarly lunch series.

### 37. Emblems of a Nation: Representations of *Brasilidade* During the 2014 World Cup

*Student Researcher* . . . . . Jake Brodsky  
*Faculty Advisor* . . . . . Naomi Wood, *Spanish*

Our larger research question was to examine the representation of Brazilian national identity throughout the World Cup and to see how Brazilians would react to the sudden influx of attention and foreigners. We surveyed mainstream, liberal, and conservative news media sources, visited local art museums, and observed street art to develop and enhance our questions about Brazilian identity, both in how Brazilians were representing themselves and being represented by foreigners. A common theme that developed in Brazilian media was comparisons between Brazil in 1950 — the last time Brazil hosted the World Cup — and current Brazil, in as many ways as possible: economically, socially, politically, structurally, and more. Another was the translation of sports terms, *i.e.*, winners vs. losers, and soccer metaphors onto the political scene, social movements, and protests. We wondered how these binary and simplified representations of different aspects of Brazil would influence the upcoming elections and social movements. One of the largest variables was the performance of the Brazilian national soccer team. What happened (Brazil lost 7–1 to Germany in the semifinals, a historic rout) ended up greatly influencing our research for the remainder of the summer. Several questions developed after the loss: How will the “performance” of the Brazilian national team impact the stability or fragility of the stereotyped hyper-masculine, athletic national identity? Within the context of two of the largest world events (2014 World Cup and 2016 Summer Olympics) how does the destabilization of soccer as a national identity due to the loss of the Brazilian national team impact the framing of elections and internal/external marketing of images related to a unified national identity? In this regard, we found that in the wake of Brazil’s loss, Brazilians turned their focus to the upcoming presidential election rather than lament the fragility of their national team and disruption of one of the iconic national images in soccer. This shows that Brazilians are ready to shed the stereotypes that may have kept them from being seen as a mature, global leader, at a time when they are being projected to the world more than ever before.



### 38. A Collaborative Effort to Design Projects for Physical Chemistry which Emphasize the Relationship Between Computer Simulations and Laboratory Experiments in Chemistry

*Student Researcher* . . . . . Paul-Miki Akpablie  
*Co-Researchers*. . . . . Lou Brand, Matthew Dickinson  
*Faculty Advisor*. . . . . Sally Meyer, *Chemistry and Biochemistry*

Advancement in our understanding of the field of chemistry has developed alongside advancement in the size and speed of computers. For example, quantum mechanics is believed to be the best theory to explain atomic and molecular systems. For a problem as simple as calculating the atomic absorption spectra of a helium atom there is no analytical solution to Schrodinger’s equation. Numerical solutions using computer simulation have been used to compare to the experimental electronic spectra of many atoms and there has been good agreement for all the atoms. As computers get faster and are able to store more data it allows larger and larger atomic and molecular systems to be calculated. Without this use of computer simulation combined with experiment we would not have validation of quantum theory. Even though the relationship between computer and lab work is so important to our understanding of many chemical theories and systems there are few projects for the physical chemistry course which teach the relationship between the two. This project is interdisciplinary between chemistry, computer science and applied mathematics. Two projects were refined this summer, one in quantum mechanics and one in chemical kinetics. Finding systems that can be studied in the physical chemistry laboratory and use both methods is a challenge. Successfully finding a chemical system, the iodine clock reaction, which has a well understood mechanism and easy to carry out measurement of the rate law, led to a project where we did a numerical integration of the rate equations to establish a time  $t$ , where the solution should turn blue-black. This time  $t$  was compared to the time we measured in the laboratory. The times we obtained match up and this provides a basis for further investigations into more complicated Iodine clock experiments which involves multiple color changes and different reaction schemes.



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