

10:36 AM **BREAK**

10:50 AM Lisa Fujitake, East Asian Studies — “*Sexism in Japanese Textbooks*”

11:04 AM Anna Kronauer and Dan Medici, Mathematics and Statistics — “*An Edge Away: Almost Unknotted Graphs*”

11:18 AM Melissa Preziosi, Psychology — “*Made Up Memories: The Study of False Memory*”

11:32 AM Ariunjargal Bat-Erdene and Ian Tibbetts, Physics and Astronomy — “*Morphological Analysis of Galaxies From High-resolution Simulations Using Automated Detection*”

11:46 AM Daniel Meyer, Economics — “*Your Guaranteed Maximum Refund? Filing Method and Tax Credit Use*”

12:00 PM – 1:00 PM

Lunch

Outdoor Patio

1:00 PM – 3:30 PM

Afternoon Session

Auditorium

Co-chairs: Chris Soto, Psychology and Cheryl Townsend Gilkes, Sociology & African American Studies

1:00 PM Xiaojie Chen, Environmental Studies — “*The Values and Preferences for Eco-labels in Seafood*”

1:14 PM Tiffany Lam and Siyuan Li, Computer Science — “*ImPACT Test-Retest Reliability of High School Athletes*”

1:28 PM Erin Breen, Psychology — “*Gender Differences in Baseline Balance Scores Using Accelerometry*”

- 1:42 PM Gagandeep Anand, Physics and Astronomy — *“Exploring the Structural Evolution of Massive Quiescent Galaxies in the CANDELS Field”*
- 1:56 PM Emmie Lai and Jacob Zhang, Museum of Art — *“The Conservation of Elie Nadelman’s Circus Performer: Art Historical Perspectives and Compositional Analysis”*
- 2:10 PM **BREAK**
- 2:20 PM Andrew Clevenger, Chemistry — *“Synthesis and Properties of Oxacalix[2]naphthalimide[2]naphthyridines”*
- 2:34 PM Holly Hogan, Sociology — *“Behavioral Health and Service Access of Dual Diagnosis”*
- 2:48 PM Olek Lato, English — *“Irena Sendler: Heroic to Jewish Children in the Warsaw Ghetto”*
- 3:02 PM Zachary Schutzman, Economics — *“Systematic Landscape Conservation in Italy”*
- 3:16 PM Waylin Yu and Ariel Batallan, Psychology — *“Early Behavioral Markers of Schizophrenia in a DISC1 (Disrupted-in-Schizophrenia-1) Genetic Knockout Rat Model”*

3:30 PM – 5:00 PM**Poster Session****Lobby**

- P-1 Ariunjargal Bat-Erdene and Ian Tibbetts, Physics and Astronomy — *“Automating Tools Used in Galaxy Analysis For Use on Simulations”*
- P-2 Sergio Baez, Chemistry and Environmental Studies — *“Blue Lake, Green Lake, Happy Lake, Sad Lake: Strategies for the Analysis of Lake Water Quality”*
- P-3 Amelia Chambers, Psychology — *“Rat Model of Concussion”*

- P-4 Rebecca Chmiel and Briana Guillory, Environmental Studies — *“How Do Short-term Weather Events Affect the Onset of Summer Stratification in Great Pond? A Comparison of 2 Years Using High-frequency Monitoring Data”*
- P-5 Raymond Chung, Psychology — *“When Means Become Ends: Building Intrinsic Reward with Progress Indication”*
- P-6 Grace DiBari and Ivan Yang, Psychology — *“Personality Development From Childhood Through Early Adulthood”*
- P-7 D'Mitri (J.R.) Farthing, Chemistry — *“Synthesis of Bis-indoles Using Acetylene Activated Aromatic Substitution with Diamines”*
- P-8 Andrew Finn, English — *“Understanding the Circumstances and Effective Pedagogies for Multilingual and L2 Learners at Colby”*
- P-9 Abby Fontaine, Psychology — *“The Testing Effect: A Tale of Two Experiments”*
- P-10 Maria Guerra, Chemistry — *“Investigations of Copper(I)-arene Complexes: Potential Differences Between Copper(I)-naphthyl Complexes”*
- P-11 Tionna Haynes, Sociology — *“Remembering and Recognizing the MVP: The Invaluable Work of Black Women and Their Many Roles in the Pursuit of Freedom”*
- P-12 Kiana Kawamura and Andrew Newcomb, Environmental Studies — *“Native Plant Community Screening on North Pond”*
- P-13 Gilbert Kiggundu, Economics — *“The Value of Riparian Forests to the Community”*
- P-14 Nicholas Kim, Chemistry — *“Structural, Spectroscopic, and Theoretical Investigation of Twisted Phenanthrenes”*
- P-15 Adam Lavertu, Biology — *“Cross-linker Method of Identifying Inter-membrane Protein Interactions”*
- P-16 DaWon Lee, Biology — *“Behavioral Responses to Ethanol in Circadian Rhythm Defective Drosophila period Mutants”*
- P-17 Janice Liang and George Voigt, Biology and Environmental Studies — *“Blooming Prospects from the Analyses of Phytoplankton in the Belgrade Lakes”*

- P-18 Sara LoTempio, Environmental Studies — *“Ethiopian Orthodox Church Forests Provide Hydrological Ecosystem Services: Evidence From Stream Sediment and Aquatic Insect Analyses”*
- P-19 Papa Loum, Sociology and African American Studies — *“Hidden in Plain Sight: The Muslim Legacy on African American Christianity”*
- P-20 Samantha Lovell and Caroline Keaveney, Environmental Studies — *“Restoration of Historical Fisheries and Ecosystem Services: Alewife Fisheries in Maine”*
- P-21 Justin Lutian and Xi Yang, Biology — *“The Effect of Phosphorylation on the Ability of Transcription Factor TaABF1 to Regulate HVA1 Gene Expression in Cereal Seeds”*
- P-22 Jeffrey Meltzer, Office of Sustainability — *“Assessing Sustainability at Colby College: Implementing a Rating System to Benchmark and Improve the College's Environmental Efforts”*
- P-23 Melissa Meyer, History — *“Not So Natural Disasters”*
- P-24 Caroline Minott, Psychology — *“To Drink or Not to Drink: Which High School Abstainers Become Heavy Episodic Drinkers During the First Semester of College?”*
- P-25 Yun Soo Park, Biology — *“Characterization of Alternations in Circadian Rhythm in a Rotenone Induced Parkinson's Disease Model of Drosophila”*
- P-26 Mary Parks, Biology — *“Jadera haematoloma Wing Development and Dimorphism”*
- P-27 Alex Plesa, Biology — *“Development of the Split-SAMP System for Identifying Transmembrane Protein Interactions”*
- P-28 Mark Ravichandran, Chemistry — *“Extreme Environments Hiding in Our Backyards”*
- P-29 Samuel Redstone, Chemistry — *“DNA Damage in Vivo: Cell-killing Potential of Nitrogen Mustard, an Anti-cancer Drug”*
- P-30 Vivek Sah, Chemistry — *“Investigating the Properties of Difluoroboron Diketone Functional Groups in a Macrocycle”*

- P-31 Stephen O'Grady and Anna Schechner, Biology and Environmental Studies
— *"LakeSmart Revisited"*
- P-32 Paul Scott, Chemistry — *"Characterization of the Major Guanosine Monoadducts Formed by Epichlorohydrin"*
- P-33 Jill Twist, Physics & Astronomy — *"Galaxy Classifications Leading to an Understanding of Our Cosmic Origins"*
- P-34 Caitlin Farrington, Katherine Cabrera Hunt, Denisha Daniels, Sonia Garcia, Elissa Guerra, Marcus Jones, Vianny Lugo, Sandra Sanchez, Niall Sefah, Tanvir Shahjahan, and Grace Uwase, CAPS5 — *"Deteriorating Water Quality in the Great Pond"*
- P-35 John Bengtson, Government — *"Historical Legacies and Participatory Democracy: Institution Building in Guatemala"*

5:00 PM – 5:30 PM

Break

5:30 PM – 7:00 PM

Dinner

Dining Room

7:00 PM – 8:00 PM

Keynote Lecture

Auditorium

"Defining the Colby Experience"

David A. Greene
President of Colby College

Session ID:

1-1

Abstract Title:

Everyday Life in China, 1920s-1930s

Presenting Author(s):

Shiyun (Jenny) Qiu ('17)

Other Authors:

Elizabeth LaCouture

Department:

Department of History, Colby College, Waterville, ME

Abstract:

This research project explores the history of everyday life in China during the 1920s and 1930s. There are two dimensions to popular understandings of this time period in China today: On the one hand, Chinese college students are nostalgic for the past, often posing in 1920s era school uniforms in graduation photographs. Similarly, the growing number of Chinese students studying abroad can now read the diaries and essays, constantly being reprinted, of their 1920s and 30s' predecessors who studied overseas. Indeed, many young Chinese people view the 1920s and 30s with a certain degree of nostalgia. We see it as a time of openness, liberation and sophistication not so different from its global counterparts. However, the official Chinese history that we learn in textbooks paints a very different picture of a period of chaos and oppression, with China facing warlords from the inside and foreign imperialist aggression from outside. These two diverging representations of the 1920s and 30s have led me to ask how people actually experienced everyday life in China during this time.

To answer this question, my research focuses on the city of Tianjin, a premier port city in northern China, near Beijing. Using municipal archives, popular magazines and newspapers, I examine Chinese ideas about family, home and urban life. This study will recast our understanding of 1920s and 1930s as neither idealistic nor chaotic. Instead, 1920s-30s was a period of coexistence between Western modern lifestyle and long-standing Chinese traditions. Moreover, my research suggests that cultural acceptance and openness during this period well exceeded the Communist era that followed.

Session ID:

1-2

Abstract Title:

Progress Towards the Synthesis and Characterization of a Copper(I)-phenyl Complex

Presenting Author(s):

Thabiso Kunene ('15)

Other Authors:

Maria Guerra ('16), Thora Maltais ('09), Mark Ziffer ('11), and Rebecca Conry

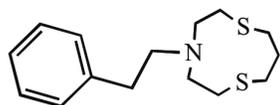
Department:

Department of Chemistry, Colby College, Waterville, ME

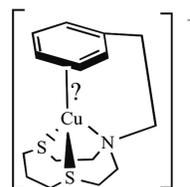
Abstract:

Compounds or complexes that contain an organic species and a copper ion are widely used organometallic reagents in synthetic organic chemistry, including as catalysts to facilitate other reactions. Such compounds include copper(I)-arene complexes, which are quite rare and thus their chemistry is not well understood. Consequently, the goal of this project is to synthesize and characterize new copper(I)-arene complexes with large ring ligands appended to arene groups such as phenyl and naphthyl. These complexes will serve as model systems to probe the factors that contribute to the strength and selectivity of the chemical bond between the copper(I) ion and the arene group.

This project is performed in collaboration with Maria Guerra, who is studying a copper(I)-naphthyl complex whereas I am targeting the copper(I)-phenyl complex shown below right. Four synthetic steps are required to make the ligand with an appended phenyl group (shown below left) and two further steps are required to make the target copper(I)-phenyl complex. Some of these steps involve species sensitive to oxygen and/or water thus requiring special synthetic techniques.

mine
ne

Target phenyl ligand



Target copper(I)-phenyl complex

Previous work on this project suggests that the phenyl group does not bind as strongly to the copper(I) ion as the naphthyl group. Therefore, the binding site of the copper ion to the phenyl and the naphthyl groups might be different. This also means that the copper(I)-arene complexes bearing phenyl and naphthyl groups may behave differently in arene-replacement reactions. These hypotheses will be tested by using several tools to characterize the target complex once it has been synthesized. In addition, the complex will be used in arene-replacement reactions in order to better understand its properties and potential uses.

Session ID:

1-3

Abstract Title:

Socioeconomic Status and Political Participation in Belgrade, ME

Presenting Author(s):

Other Authors:

Shelby O'Neill ('15)

Sandy Maisel

Department:

Department of Government, Colby College, Waterville, ME

Abstract:

This senior thesis analyzes the standard socioeconomic status model of political participation. This explanatory model holds that socioeconomically advantaged people—people with higher incomes, greater wealth, job statuses, and education—are more willing and able to participate in politics than disadvantaged people. This participatory inequality increases as the political act becomes more difficult or demanding, as in voting being less stratified than writing a congressperson. Moreover, inequalities in political input translate, quite directly, to inequalities in political output, posing a challenge to our social conception of democracy which requires, at definitional minimum, equal access to the political system for all members of the demos.

In my thesis, I am analyzing whether the socioeconomic status model of political participation holds in a localized political setting. I am using Belgrade, ME—a class diverse lakeside town—as a case study. Belgrade, ME is interesting as a study because, at least a priori, it appears that political advantage in the town is not linked to standard socioeconomic advantage: many members of the Select Board, for example, do not have traditional indicators of socioeconomic advantage and interviewees suggested that political advantage might be tied to other sources, like status, in a Weberian sense, or length of residency, or age, or social network. I test this alternative hypothesis both quantitatively and qualitatively, exploring roots of political motivation and the prevalence, or lack thereof, of socioeconomic stratification in Belgrade politics.

Session ID:

1-4

Abstract Title:

Gene Regulatory Mechanisms of the Circadian Rhythm can be Modeled and Compared Using Systems of Differential Equations

Presenting Author(s):

Olivia Lang ('15)

Other Authors:

Stephanie Taylor

Department:

Department of Computer Science, Colby College, Waterville, ME

Abstract:

Our world revolves in a 24-hour cycle so it is not surprising that life on Earth has developed a matching 24-hour rhythm of daily behavioral and metabolic processes/functions. This rhythm, called the circadian rhythm, is controlled by the presence of a core system of proteins that up-regulate and down-regulate gene expression patterns to fit the 24-hour cycle. Computers supplement experimental data in circadian research by using math equations to simulate the circadian gene regulatory system in the cell (computer-simulated experiments are called *in silico*). Sets of equations, or models, that have been published in scientific literature use different mechanisms to simulate the same gene regulatory network. The goal of a modeler is to create a model that best reflects experimental data while minimizing the complexity of the set of equations. More complex models are more computationally expensive.

My goal is to compare and evaluate the effect of the different combinations of mechanisms used in four different published fly-clock models (Bagheri 2008, Xie 2007, Kuczynski 2007, and Ruoff 2005). Currently, the models are very different in their complexities and in the sets of mechanisms they use so by creating a uniform "Kitchen Sink" model in which we can turn features "on/off," we create a more controlled experiment to observe the effect of different combinations of mechanisms. We are collecting data on the model's sensitivity to different mechanisms so that we can build a better model that can better reflect and react like an *in vivo* circadian rhythm.

By determining the best fit models, we can not only make predictions about the biochemical mechanisms implemented by a cell, but we can also perform experiments and obtain results *in silico* using less time and fewer resources than *in vivo* experiments. The model I am modifying ultimately contributes to speedier progress and development in the research of circadian rhythms.

Session ID:

1-5

Abstract Title:

Sexism in Japanese Textbooks

Presenting Author(s):

Lisa Fujitake ('17)

Other Authors:

Hideko Abe

Department:

Department of East Asian Studies, Colby College, Waterville, ME

Abstract:

Despite the fact that publishing companies (both in Japan and the US) have recently revised guidelines that authors should consider when producing new textbook material in regards to gender bias, sexism in Japanese textbooks continue to persist, and therefore, this subject deserves closer attention.

This project aims to study the significance of gender stereotypes prevalent in Japanese textbooks used by colleges and universities worldwide, and whether this leads to wider implications in Japanese society. Additionally, I believe this study is important because despite the fact that Japan is seen as one of the most highly developed countries, the idea of traditional gender roles are evident in Japanese societies today, which could be reinforced by the use of Japanese textbooks.

To investigate gender inequality in Japanese textbooks, I have examined five widely used Japanese language textbooks, and studied the terms and expressions that portray women's jobs and roles as well as men's. The number of female and male occupations that appeared in the textbooks was also counted. My findings show that women are often associated with restricting roles and often portrayed less frequently than males with jobs. Furthermore, we see some linguistics characteristics which are different between female and male characters in the textbooks, where women are shown to speak with more honorifics and formal expressions than men.

This study will serve as a way to advise Japanese learners of the way gender differences are overplayed in textbooks. Also, I believe it is important to make teachers, students and publishers aware of the way traditional gendered speech styles or roles are overstressed in textbooks, and possibly the need for gender-neutral, non-sexist textbooks.

Session ID:

1-6

Abstract Title:

An Edge Away: Almost Unknotted Graphs

Presenting Author(s):

Anna Kronauer ('16) and Dan Medici ('16)

Other Authors:

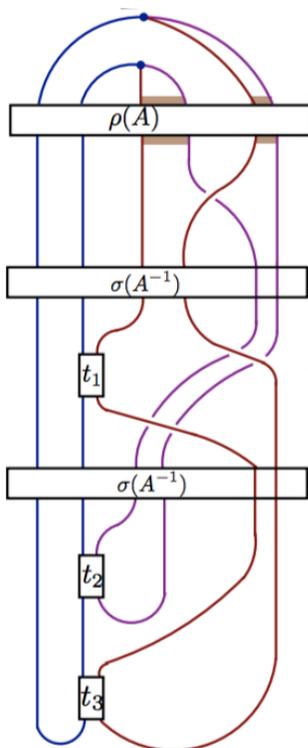
Scott Taylor

Department:

Department of Mathematics and Statistics, Colby College, Waterville, ME

Abstract:

Knots are all around us: neckties, shoelaces, climbing ropes, computer cables. It is perhaps surprising that knots are also mathematical objects. Indeed, knot theory has grown into a subject that has challenged mathematicians for over a century.



An intriguing object in knot theory is the spatial Θ -graph, a network in three-dimensional space consisting of two joined vertices and three edges. The simplest type of knotted Θ -graph is called “minimally knotted”: the graph itself must be knotted, but each of its individual parts are unknotted. The goal of our project is to describe an infinite class of distinct, minimally knotted graphs.

Previous work suggested a template for drawing minimally knotted Θ -graphs (pictured above). We are searching for inputs to the template that output minimally knotted graphs. The difficult part of our project lies in showing that our template can produce *infinitely* many of these graphs. Examining specific examples of graphs is simply not enough; the project requires us to use a more creative approach by exploring recurring patterns in the graphs. Thus far, we have discovered infinitely many inputs that yield minimally knotted graphs; our next challenge is to show that these graphs are, in fact, distinct from one another.

Session ID:

1-7

Abstract Title:

Made Up Memories: The Study of False Memory

Presenting Author(s): Other Authors:

Melissa Preziosi ('15)

Jennifer Coane

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

The study of false memory can reveal how our memories may deceive us, even when we are confident in their accuracy. False memory is defined as remembering an event that did not occur. When a list of words highly related to a general theme (e.g., *puppy*, *boxer*, *collar*) is presented, participants will often report seeing a critical item (CI; e.g., *dog*) on a subsequent memory test, although this CI was not in the list. According to Activation/Monitoring theory, automatic spreading activation during encoding and retrieval increases the familiarity of the CI and source monitoring errors at retrieval result in misattribution of the CI's familiarity. These false memories are robust and resistant to warnings and are often made with high degrees of confidence by participants. In many cases, responses to CIs are indistinguishable from those to list items; however, response latencies can dissociate between true and false memories even when accuracy or confidence cannot.

In the Memory and Language Lab this summer we have tested false memory with lists of words that share features with the CI (e.g., *hound*, *puppy*, *wolf*), words often seen together in context with the CI (e.g., *flea*, *collar*, *bone*), and words which sound similar to the CI (e.g., *frog*, *log*, *jog*) to better understand how different definitions of "similarity" modulate the effect. To further explore the influence of the automatic activation and controlled monitoring, we are also using mouse tracking software to examine the underlying movement dynamics of false memory while participants make a recognition decision.

This research will lead to a better understanding of the spreading activation process within memory for information or events related to one another in different ways. It also has broader applications in real-world contexts, such as eye-witness testimony or student testing.

Session ID:

1-8

Abstract Title:

Morphological Analysis of Galaxies From High-resolution Simulations Using Automated Detection

Presenting Author(s):

Other Authors:

Ariunjargal Bat-Erdene ('15) and Ian Tibbetts ('15)

Elizabeth McGrath

Department:

Department of Physics and Astronomy, Colby College, Waterville, ME

Abstract:

Only relatively recently have computational advances made it possible to develop a fully cosmological technique for simulating galaxy formation. These advances allow us to study not only a single isolated galaxy, but also take into account its surrounding environment, which is important for understanding how galaxies develop within the evolving universe. Employing a similar technique and the prior work of a Colby student, Ryan Cole, our project's goal is to produce more realistic morphologies of galaxies using a new generation of simulations that will be compared with actual observations in order to test their accuracy. In addition, we are using them as a benchmark to understand what physical information we can recover from observations, given the limitation of often grainy, low-resolution images. The Python programming language was used to automate the process of predicting the morphologies. Current challenges to our approach include developing a set of parameters that will work uniformly for many different simulations without the need for human interaction. In the end of the project, we hope to come up with better simulations that agree well with actual observations. This project is of interest to us because of its interdisciplinary nature that combines the fields of Astrophysics and Computer Science. It is also relevant to the scientists in the field and to Colby College since it is a part of a new collaboration between observational and theoretical astronomers; the college is leading the way in the analysis of high-resolution simulations to inform observations of galaxy structure, which are important for understanding our own cosmic origins. Furthermore, we will be attending the annual galaxy workshop hosted by Professors Avishai Dekel and Joel Primack at UCSC from August 11-15 to share our achievements with fellow astronomers.

Session ID:

1-9

Abstract Title:

Your Guaranteed Maximum Refund? Filing Method and Tax Credit Use

Presenting Author(s):

Daniel Meyer ('16)

Other Authors:

Samara Gunter

Department:

Department of Economics, Colby College, Waterville, ME

Abstract:

Americans are changing the way they pay their taxes. From 2004 to 2011 the percentage of tax returns filed by hand fell from 46.1% to 18.0%. During the same period the percentage of returns filed electronically rose from 51.3% to 81.7%.

Do-it-yourself tax preparation software advertise that their service will provide you with a larger refund, but does using a tax preparation service or software actually affect the size of refund received? We investigate this question and attempt to establish whether or not this relationship exists.

Our project uses zip-code level tax return data provided by the IRS to examine the effects of filing method on refund size and credit use. Doing this analysis directly would be problematic as there are many factors, such as income, that influence how a person files their taxes that also affect the size of their refund. We combine the IRS data sets mentioned above with county demographic data provided by the Census, internet connectivity data provided by the FCC, and internet search data provided by Google in order to instrument for filing method and minimize the effect of this selection bias.

So far we have utilized the campus GIS lab to create visual representations of the changes in filing method over the years. We have also run some preliminary regressions between internet connectivity and filing method with encouraging results. We are optimistic that we are headed in a promising direction.

There has not been any recent scholarly work done to evaluate the effect of filing method on the size of refunds received. There has been a sweeping change in the landscape of American tax filing method; we hope to discover whether or not these changes have affected the amount of taxes individuals are actually paying.

Session ID:

2-1

Abstract Title:

The Values and Preferences for Eco-labels in Seafood

Presenting Author(s):

Xiaojie Chen ('16)

Other Authors:

Loren McClenachan and Sahan Dissanayake

Department:

Department of Environmental Studies, Colby College, Waterville, ME

Abstract:

Global fisheries crashes have led to an increasing recognition for the need to relieve pressure from the most overfished stocks, while maintaining economic benefit to struggling fishing communities. Seafood labels are touted as one way to shift consumer demand towards seafood that is more sustainably harvested. At the same time consumers' willingness to pay for ecologically and socially sustainable labels is not known. In this study we use a choice experiment survey to analyze people's willingness to pay for sustainable seafood in Maine. Along with the traditional ideas of ecological sustainability and locality, we also explore a social aspect of sustainability. Social sustainability entails increasing participation by fishermen in decision-making, community economic development, and equitable distribution of profits that benefits the coastal community (Micheli et al. 2014). Sometimes, suppliers may "cheat" by labeling seafood with vague terms such as "sustainable," "local," or "promotes community development" without evidence. We examine whether or not people would be willing to pay more for a certified label, such as Marine Stewardship Council (MSC) certified or Fair Trade certified, than for a vague term on a seafood menu. Each choice question in the survey consists of four different attributes; ecological sustainability, origin, socioeconomic benefits, and cost. The data were collected using in-person surveys administered in coastal Maine and were analyzed using conditional logit and multinomial logit econometric models. Preliminary results show that consumers are willing to pay more for the certified programs than the vague labels. On average, we find that people tend to pay the highest for the certified labels: \$15 more for Gulf of Maine certified, \$12 for MSC certified, and \$12 for Fair Trade certified.

Micheli, Fiorenza et al. 2014. A system-wide approach to supporting improvements in seafood production practices and outcomes. *Frontiers in Ecology and the Environment* 12: 297–305. <http://dx.doi.org/10.1890/110257>

Session ID:

2-2

Abstract Title:

ImPACT Test-Retest Reliability of High School Athletes

Presenting Author(s):

Tiffany Lam ('17) and Siyuan Li ('17)

Other Authors:

Bruce Maxwell

Department:

Department of Computer Science, Colby College, Waterville, ME

Abstract:

The purpose of this project is to evaluate the test-retest reliability of Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT®), a computerized neurocognitive evaluation. The Maine Concussion Management Initiative [MCMII] has been working with Maine high schools since 2009 to administer the test to high school athletes and many schools have had students take the ImPACT test multiple times. We analyzed the results of high school athletes who took the ImPACT test at least twice and compared their performances.

We used the programming language Python and Matplotlib, a Python plotting library, for the data analysis and visualization. We first determined valid subjects and generated a variety of subsets for evaluation. Our total data set consisted of 5607 subjects with at least two valid baseline tests. We used histograms, pie charts, linear regressions, scatter plots, and density plots to visualize the ImPACT composite scores and symptom scores. To determine the test-retest reliability, we calculated both the Pearson's correlation coefficient and the Inter-class correlation coefficient to quantify the consistency in performance between an athlete's two baseline scores. The results vary between reliable scores ($R = 0.65$) and less reliable scores ($R = 0.21$), with some variation for subsets of the data. These results are consistent with other test reliability analyses of ImPACT, and our population size is at least an order of magnitude larger than any prior study.

If ImPACT is a reliable measure for neurocognitive function, we could encourage the implementation of the test in more high schools and use demographic and other information to identify factors that affect cognitive performance, such as concussions in high school athletics.

Session ID:

2-3

Abstract Title:

Gender Differences in Baseline Balance Scores Using Accelerometry

Presenting Author(s):

Erin Breen ('17)

Other Authors:

Paul Berkner

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

This project has been part of an ongoing research program conducted under Maine Concussion Management Initiative. I have worked on this project throughout the year as a Presidential scholar, and it has been exciting to be able to continue working on the project this summer. Over the past year, we have collected baseline and post concussion balance data from 246 Colby College athletes on a smartphone app that uses the accelerometer found in an iPhone®. The goal was to establish normative data for comparisons to concussed athletes. This information is critical in establishing gender specific normative data for the evaluation of concussions.

The iPhone® is placed between the shoulder blades using a GoPro® harness to give us the most accurate measure of trunk sway. Then each individual was tested in 9 positions using our device and was also tested using Balance Error Scoring System as a control measure.

Our initial evaluation of the data showed that there are measurable and significant gender differences in sway independent of height using our device. Three out of nine positions (tandem stance, single leg stance eyes open, and single leg eyes closed) gave us measurable and significant differences when comparing between genders.

We have been able to show that females have better balance than males in our population of college athletes using our unique test we created. Because a loss of balance has been positively correlated with sports related concussions (Guskiewicz 2001), and women are at higher risk for concussions than men (Dick 2009), in the future, we hope to be able to use this app to accurately diagnose concussions using gender specific norms.

Session

2-4

Abstract

Exploring the Structural Evolution of Massive Quiescent Galaxies in the CANDELS Field

*Presenting thors(s):**Other Authors:*

Gagandeep Anand ('15)

Elizabeth McGrath

Department:

Department of Physics and Astronomy, Colby College, Waterville, ME

Abstract:

The most massive galaxies in the Universe today are a class of elliptical galaxies that are often referred to as “red and dead” galaxies. This means that they consist mainly of low-mass stars, which are redder in color, and have effectively ceased their star formation, becoming quiescent. The mechanism that causes these galaxies to become quiescent is currently unknown and is an important question in observational cosmology. Since there is a correlation between star formation rate and whether a galaxy is disk-dominated or bulge-dominated, studying the structural evolution of these galaxies through time may help identify this mechanism. My project focuses on galaxies in a field of the CANDELS survey conducted by the Hubble Space Telescope that is comparable to 1/4th the size of the full moon. Using factors including mass, age, and color, I narrowed down the 35,445 galaxies in this field to find 379 that qualify as progenitors to today's massive quiescent population, which are roughly an order of magnitude more massive than our own Milky Way Galaxy. I then fit structural models to these galaxies in order to identify the percentage of them that are disk-dominated versus the percentage that are bulge-dominated. In the standard galaxy formation paradigm, massive galaxies are formed through the hierarchical build-up of smaller galaxies. An important prediction of this model is that the resulting galaxies would be spheroidal-shaped, rather than flattened, disk-dominated galaxies. Therefore, a significant portion of disk-dominated galaxies among these progenitors would imply that modifications need to be made to the standard galaxy formation paradigm. My results show that ~85% of the selected massive quiescent population are bulge-dominated, and of these, ~20% have significant disk components. Further comparison with theoretical models is needed to determine if mergers of smaller galaxies can fully explain the existence of today's massive quiescent population.

Session ID:

2-5

Abstract

The Conservation of Elie Nadelman's *Circus Performer*: Art Historical Perspectives and Compositional Analysis

Presenting Author(s):

Emmie Lai ('15) and Jacob Zhang ('16)

Other Authors:

Ramey Mize, Beth Finch, Paige Doore,
and Diana Tuite

Department:

Colby College Museum of Art, Colby College, Waterville, ME

Abstract:

Elie Nadelman (1882-1946), a Polish-American artist who migrated from Paris to New York in 1914, was one of America's most accomplished sculptors of the 20th century. This research project examines approaches to conservation of his *Circus Performer* (c. 1919) which will be going on loan this fall as part of the New York Historical Society's traveling exhibition, *The Folk Art Collection of Elie Nadelman: Making it Modern*. The work weighs around 10 pounds and is 33 $\frac{3}{4}$ x 8 $\frac{1}{2}$ x 5 $\frac{1}{2}$ inches. Current documents indicate that it is carved from cherry wood, stained, painted with Prussian blue, and a gesso was applied. However, this information has not been verified recently. Some questions this project seeks to answer are: Is this information correct? If not, what is the work composed of? The surface is intentionally aged, drawing its inspiration from American and European folk art, which poses a challenge to conservators. Our project's objective is to characterize the composition of the surface layers so that the object can be appropriately exhibited and conserved. We will also perform some art historical research on this and similar Nadelman works.

This project incorporates a variety of different research methods. The object conservator for the museum, Ron Harvey, was consulted for information on conservation. Primary and secondary literature will be used to learn more about Nadelman and his methods. We have contacted several institutions, including the Whitney Museum of American Art and the Smithsonian, for information regarding their Nadelman works from the same time period. The results of this research will enable the museum to better approach other Nadelman sculptures, facilitate in their conservation and potentially influence future acquisitions. More immediately, this project will enable the New York Historical Society to have the most accurate information as they prepare for their upcoming exhibition.

Session ID:

2-6

Abstract Title:

Synthesis and Properties of Oxacalix[2]naphthalimide[2]naphthyridines

Presenting Author(s):

Andrew Clevenger ('15)

Other Authors:

Jeffrey Katz

Department:

Department of Chemistry, Colby College, Waterville, ME

Abstract:

Synthetic organic chemistry is the study of using chemical reactions to form previously unknown compounds or highly complex compounds found in nature. The Katz Group has developed an efficient synthesis of a class of molecules called oxacalixarenes. Oxacalixarenes are not found in nature but, due to their three-dimensional structure, are promising candidates for molecular sensing and recognition applications. My project is to synthesize a “tweezer-shaped” oxacalixarene (an oxacalix[2]naphthalimide [2]naphthyridine) that is capable of binding a small organic molecule and holding it in the tweezer-like cavity. Previous studies in the Katz group have shown that binding molecules in this way is detectable through a change in fluorescence, and thus oxacalixarene-tweezers are promising candidates for chemical sensors. I will attempt to overcome problems inherent in the earlier synthesis – low chemical yield and poor solubility – by appending additional groups to my starting materials that will enhance reactivity and render my target more soluble. I will then study the fluorescence and binding properties of my synthesized oxacalix[2]naphthalimide[2]naphthyridines.

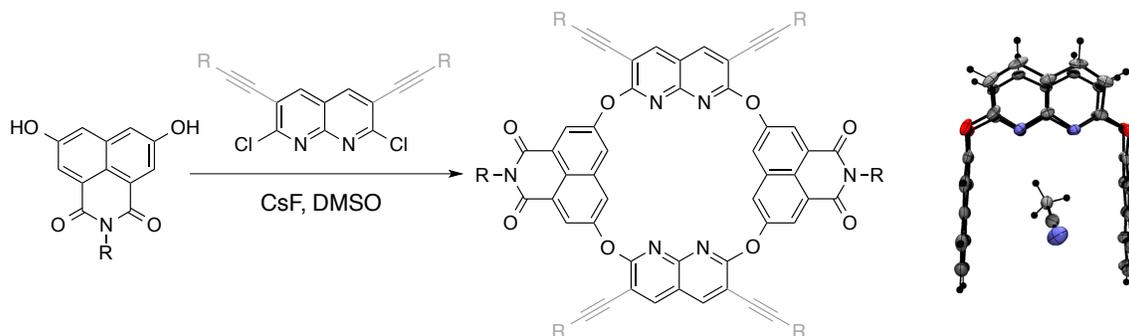


Figure 1: (above left) Synthesis of an oxacalix[2]naphthalimide[2]naphthyridine (above right) X-ray crystal structure of an oxacalixarene with a guest molecule held in the cavity

Session ID:

2-7

Abstract Title:

Behavioral Health and Service Access of Dual Diagnosis

Presenting Author(s):

Holly Hogan (16)

Other Authors:

Matthew Archibald

Department:

Department of Sociology, Colby College, Waterville, ME

Abstract:

This project examines the diagnoses of mental illness and substance abuse disorder. The data collected is used to interpret how the two diagnoses are related and the social factors that contribute to diagnoses. It is important to look at these social factors, so that treatment can be examined. Treatment needs to be integrated for those who are dually diagnosed. The literature shows that many people suffer from both mental illness and substance abuse disorder, but only receive treatment for one diagnosis. Treating only one of the problems leads to the treatment being less effective, according to the literature. Dual diagnosis is shunned, because of the lack of integrated treatment facilities. It is critical that people with dual diagnosis get an accurate diagnosis and receive treatment that meets all of their behavioral needs. This is critical to examine, so that more people can be healthy and contributing members of society. Social capital should not influence a person's access to services that provide care. In a Maine acute psychiatric unit, observational studies were used along with quantitative data to determine patients' social demographics. The mental illness and substance abuse disorders were broken into subgroups to see if particular types of each diagnosis contributed to service access. I compare what the literature says about correctional facilities and dual diagnosis with the research findings and literature on dual diagnosis in acute psychiatric wards. Does setting influence treatment and diagnosis? My hypothesis is correctional facilities make more dual diagnosis diagnoses than acute psychiatric wards, primary care physicians, and treatment facilities, such as drug and alcohol rehabilitation programs. Dual diagnosis impacts everyone in some capacity, so it is important to identify the best integrated treatments. The diagnosis wreaks havoc at Colby College. I want to educate students on dual diagnosis and treatment options.

Session ID:

2-8

Abstract Title:

Irena Sendler: Heroin to Jewish Children in the Warsaw Ghetto

Presenting Author(s):

Other Authors:

Olek Lato ('15)

Tilar Mazzeo

Department:

Department of English, Colby College, Waterville, ME

Abstract:

Irena Sendler is an unsung hero to thousands of Jewish children who owe their lives to her heroic actions during World War II. Between the years 1942 and 1943 – when the Nazis captured her for her assistance towards persecuted individuals – she was responsible for the rescue of over 2,500 Jewish youth, and their escape from the Warsaw Ghetto and war-torn areas.

She worked most notably for Żegota, or the Konrad Żegota Committee, which was an alias for the Polish Council to Aid Jews. The work of Żegota provided food, false documentation, and medical assistance to Jews located in the Warsaw Ghetto, but played also a large part in helping thousands of Jews survive and escape the war. My work this summer is to be along side Professor Tilar Mazzeo to investigate the details of Irena Sendler's work, and her tremendous contribution to the Jewish community during World War II. Professor Mazzeo is gathering documents and information that will serve in her book about the heroism and the Warsaw Ghetto.

My research has been primarily in primary documents collected from survivors of World War II, and from those who were directly in contact with Mrs. Sendler. I have been transcribing testimonials from Polish into English, and examining the details of the Warsaw Ghetto, Żegota, and the key figures involved in the relief work.

I hope that my work will be able to shed light onto the extraordinary work of Mrs. Sendler and the organization, as well as provide important testimonials and information for Professor Mazzeo to include in her upcoming work.

Session ID:

2-9

Abstract Title:

Systematic Landscape Conservation in Italy

Presenting Author(s):

Zachary Schutzman ('16)

Other Authors:

Sahan Dissanayake

Department:

Department of Economics, Colby College, Waterville, ME

Abstract:

Natura 2000 is an ecological network of protected areas, set up to ensure the survival of Europe's most valuable species and habitats. Unfortunately given economic considerations, i.e. the cost of purchasing land, preventing conversion and development, and managing selected areas, it is necessary to prioritize the protection of the selected lands within a country. When prioritizing sites in a landscape to be conserved, there are a number of important factors to consider, including site attributes such as size and shape, populations of threatened species, the overall quality of the landscape, and systemic attributes such as contiguity and proximity of selected sites. This research uses the Natura 2000 data for Italy and creates integer programming models for optimal site selection and land allocation. In the presentation, I will introduce the research questions, present the integer programming models, introduce the data, and discuss results using maps and stylized graphs.

Session ID:

2-10

Abstract Title:

Early Behavioral Markers of Schizophrenia in a DISC1 (Disrupted-in-Schizophrenia-1) Genetic Knockout Rat Model

Presenting Author(s):

Other Authors:

Waylin Yu ('15) and Ariel Batallan ('15)

Melissa Glenn

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

Alteration of disrupted-in-schizophrenia-1 (DISC1) protein expression has widespread consequences on the development and function of the central nervous system. DISC1 gene translocation in humans affects numerous brain areas, resulting in phenotypes such as reduced grey matter in the prefrontal cortex and abnormal hippocampal activation. At the subcellular level, DISC1 is expressed in areas (e.g. centrosome, mitochondria) that play important roles in neuron migration, branching, and signal transduction. Abnormalities in DISC1, and the resulting dysfunction of areas in which the protein is present, have been linked to psychiatric disorders. In the past decade, there has been particular interest in the DISC1 gene as a risk factor for schizophrenia. Research has revealed a strong correlation between DISC1 disruption and the anatomical, cognitive, and behavioral characteristics of schizophrenia in human populations, as well as mice models. A DISC1 disruption model in rats would yield data that is more translational for humans than that of mice given the greater human-rat similarities in cognition and genome base pairs and has only recently been made available. Several aspects of the model remain to be validated and was the aim of the present research. Our main goal is to document behavioral profiles of weanling and adolescent Sprague-Dawley rats with biallelic deletion within the DISC1 gene—otherwise referred to as a DISC1 gene knockout. Past research from our lab successfully demonstrated greater locomotive and anxious behavior in adult Sprague-Dawley DISC1 knockouts compared to wildtypes, supporting the DISC1 knockout model as a viable model of schizophrenia in rats. The current focus earlier in life is intended to observe early markers in the behavior of DISC1 knockout rats comparable to the subtle behavioral and intellectual abnormalities observed in otherwise healthy human adolescents who later develop schizophrenia.

Session ID:

P-1

Abstract

Automating Tools Used in Galaxy Analysis For Use on Simulations

Presenting Author(s):

Other Authors:

Ariunjargal Bat-Erdene ('15) and Ian Tibbetts ('15)

Elizabeth McGrath

Department:

Department of Physics and Astronomy, Colby College, Waterville, ME

Abstract:

We are automating the process of analyzing the morphology, or structure, of simulated galaxies, so that they can be compared to that of real galaxies as observed by the Hubble Space Telescope. Our goal is to evaluate the quality of the current generation of simulations, and to discover how they can be improved in the future. Achieving accurate simulations of galaxies would provide invaluable details to astronomers that are unattainable from observation alone. Additional data, like multiple viewing angles and accurate mass measurements, would help our understanding of the physical mechanisms of galaxy formation and upgrade future observations. Because of the colossal number of images, which consist of several hundreds per galaxy, it is important to automate existing tools that are used by astronomers interactively and output their aggregate results. These tools are typically used manually on observed images, but we are running them without human supervision on simulated images to obtain a refined model of the galaxy's structure. Thus, we used the Python programming language, taught at Colby, to accomplish that goal. The program runs on an arbitrary set of images and takes advantage of parallel computing to improve runtime. The interdisciplinary nature of this project makes it unique, combining the fields of Computer Science and Physics/Astronomy. It also establishes Colby College as the center of a collaborative work that merges theoretical and observational approaches to understanding galaxy formation and evolution. Therefore, our efforts will not only benefit astronomers, but also bring further research opportunities to Colby with galaxy simulations.

Session ID:

P-2

Abstract Title:

Blue Lake, Green Lake, Happy Lake, Sad Lake: Strategies for the Analysis of Lake Water Quality

Presenting Author(s):

Sergio Baez ('17)

Other Authors:

Francis Dunham ('16), Denise Bruesewitz, and D. Whitney King

Department:

Departments of Chemistry and Environmental Studies, Colby College, Waterville, Maine

Abstract:

We have been working on sampling methods to assess the health of the Belgrade lakes: temperature and oxygen data collection in all of the Belgrade lakes; and maintenance of Goldie. Each week the Belgrade lakes are surveyed for water column temperature and oxygen using the Colby Boston Whaler and a YSI data sonde. This data adds directly to the 40 year record of water quality measurements in the Belgrade lakes. The second method, Goldie, deployed in Great Pond in 2013, is an automated temperature, oxygen, fluoresce, and light measuring buoy that relays its data to a public website every 15 minutes. The data collected by Goldie is used to determine the health of Great Pond in near real time. Both of these methods are essential to the monitoring of the Belgrade lakes, and to bringing awareness to the community and the state about the health of the lakes. The data can further be used to inform property values in the Belgrade area, support of new lake regulations, and increasing awareness of potential hazards to the Belgrade Lakes and others throughout the state of Maine.

Classical profiles are collected using a team of two student researchers, a boat, and a sonde. This method provides a large scale of data collection from many sites within a day. While a large amount of data is collected from a large area, this profile is episodic, takes time to complete, can be deterred by weather, and requires additional steps after the fieldwork before analysis can occur. The Goldie profiler is based on an automated sampling buoy that can log data, relay data to Colby, translate the data into simple graphs and illustrations, and post them on a web server, all in the fraction of the time it would take a classical profile to complete. This method works like an underwater weather station that the community can access for daily lake conditions. Goldie's data collection is not affected by the weather since it does not need to be removed during a storm. However, buoys require regular maintenance, can only be deployed during ice-free conditions, and are limited to only one lake at a time. This work will compare and contrast the benefits and limitations of the two sampling strategies relative to cost, time, data quality, and community outreach.

Goldie data can be accessed 24/7 at web.colby.edu/lakes, and more information on its worldwide contribution can be accessed at the Global Lake Ecological Observatory Network website, GLEON.org

Session ID:

P-3

Abstract Title:

Rat Model of Concussion

Presenting Author(s):

Amelia Chambers ('16)

Other Authors:

Waylin Yu ('15) and Melissa Glenn

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

According to the Centers for Disease Control and Prevention, traumatic brain injuries (TBI) contribute to approximately one third of injury-related deaths in the United States. Children and adolescents are at an increased risk for TBI, with nearly half a million annually being seen in emergency departments. Of these injuries, approximately 75% are concussion or other forms of mild TBI and evidence is mounting that even these mild forms may have significant far-reaching adverse effects on cognition and emotional functioning. One way that researchers study TBI is with animal models. Accordingly, there are several models that have been developed and that are used in the field. However, many of the models are limited in how well they represent the type, severity, and symptomology of injuries that occur in humans. Thus, the goal of present study is to develop and test a new model of concussion in rats. One limitation to existing models in the field is that the animal's head is immobilized and struck by a moving object. By contrast, many injuries in humans, particularly sports-related injuries, occur when the person is also in motion. This results in a rotational force upon the person's head that is considered by many to be a key component to the persistent negative effects that follow. We are attempting to more deliberately incorporate this feature into our rat model by developing an apparatus in which the rat is in motion and comes into contact with a stationary object. We have constructed the apparatus and proof-of-concept testing begins in the coming weeks. This project has the potential to open the door to a new way to study concussion and expand our understanding of the injury. It will also complement and add to work already ongoing at Colby on sports-related concussion in humans.

Session ID:

P-4

Abstract Title:

How Do Short-term Weather Events Affect the Onset of Summer Stratification in Great Pond? A Comparison of 2 Years Using High-frequency Monitoring Data

Presenting Author(s):

Other Authors:

Rebecca Chmiel ('17) and Briana Guillory ('16)

Denise Bruesewitz

Department:

Department of Environmental Studies, Colby College, Waterville, ME

Abstract:

Lakes in temperate climates develop thermal stratification, which in turn affects development of algal blooms, depletion of oxygen in the bottom layer of the lake, and fish kills. Lake stability is a measure of how 'strong' the stratification is, or how much energy would be required to mix the stratified layers of the lake. Examining the relationship between lake stability and atmospheric variables reveals the physical dynamics of the lake. The data from "Goldie", an automated high frequency monitoring buoy in the deepest point of Great Pond, Maine, allows us to measure water temperature and dissolved oxygen at various depths for the 2013 and 2014 seasons. Using the Global Lakes Ecological Observation Network (GLEON) program Lake Analyzer, we can calculate the Schmidt stability and Buoyancy frequency of two years of late spring/early summer data to understand how weather events such as a period of rapid warming, or a storm event may alter the onset of summer stratification. We selected average daily wind and temperature readings as indicators of storm events and general weather conditions. Although stability is typically increasing during the late spring/early summer period, days when average wind speed is unusually high exhibit decreased stability, which may slow the onset of stratification. If this occurs the thermocline would be pushed lower, and more oxygen rich water would be available for organisms. However, when the thermocline is high, there is a large hypoxic zone where many fish cannot live. Additionally, we are examining how the onset of summer stratification affects the amount of dissolved oxygen in both the epilimnion and the hypolimnion, which is critical for the organisms in these habitats. The complex interactions between wind forcing, stratification, temperature, and the availability of oxygen are important in understanding the underlying forces that affect the ecology of the lake.

Session ID:

P-5

Abstract

When Means Become Ends: Building Intrinsic Reward with Progress Indication

Presenting Author(s):

Raymond Chung ('16)

Other Authors:

Travis Carter

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

People have long wondered about the purpose of living, and why we do the things we do. Studying animals suggests that actions are primarily driven by need (Hull, 1935). Yet, humans often do things independently of physical need. The most blatant example is the tendency to hoard money. Though money is but a means to an ends, people rarely consider themselves working towards the ends; they work for the money, thus vesting the means with greater value than it should logically have. Studies have even shown that mediums besides money, such as points, can distort cost-benefit evaluation and justify greater effort (Hsee, Yu, Zhang, & Zhang 2003). Why would people have this unreasonable obsession with means? The psychological study of motivation proposes that there exists intrinsic needs besides our physical ones, which provide intrinsic rewards for their fulfilment (Deci, 1972; Deci & Ryan, 2000). Studying intrinsic reward will allow us to understand why people do things that don't directly benefit them. We can begin this exploration by documenting how a means becomes an end in of itself. We hypothesize that after repeated exposure, intrinsic reward is attached to a means that allows it to be enjoyable independently of an end. The proposed study will ask participants to perform one of two mundane tasks (the means) for a reward (end). Some participants will be given indication of progress, simulating multiple exposure (progressive indication system), while others will simply perform the task and receive the award – single instance of exposure to the means (control). After completing the first task, they will be allowed to choose either to repeat the task or do the other one with no additional reward. It is predicted that a progressive indication system would increase the likelihood of a participant to want to repeat the task.

Session ID:

P-6

Abstract Title:

Personality Development From Childhood Through Early Adulthood

Presenting Author(s):

Grace DiBari ('16) and Ivan Yang ('17)

Other Authors:

Christopher Soto

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

The present research's goal was to examine how, on average, personality differed by age and gender from early childhood to early adulthood (ages 3 to 20). In order to do this, we surveyed the parents of 16,000 children and adolescents to obtain personality information. Past research has shown that childhood personality can be generalized into six broad dimensions, known as the Little Six. These six dimensions are Extraversion, Agreeableness, Conscientiousness, Neuroticism, Openness to Experience, and Activity, and they each can be further broken down into more-specific facet traits (e.g., the Extraversion facets of sociability and enthusiasm). Therefore, we analyzed each of these personality dimensions and its facets by age and gender. The analysis revealed that Extraversion and Activity decreased across childhood and adolescence, Agreeableness and Conscientiousness decreased during late childhood and early adolescence before increasing from late adolescence into early adulthood, Openness decreased during childhood and early adolescence, and Neuroticism increased during childhood. Analysis by gender revealed that, during adolescence, Neuroticism increased in girls and remained relatively constant for boys. Most facet traits revealed similar age and gender trends to their broad Little Six dimension, but some exceptions did occur, most notably for Neuroticism, Openness, and Agreeableness. For example, within the Openness dimension, during childhood and early adolescence curiosity and exploration decreased but daydreaming and fantasy increased. Our research suggests that the Little Six personality dimensions should become the standard for measuring youth personality traits, and it also highlights the importance of examining facet trait-level traits in personality research. Most importantly, our research shows that personality changes in important ways across childhood and adolescence.

Session ID:

P-7

Abstract Title:

Synthesis of Bis-indoles Using Acetylene Activated Aromatic Substitution with Diamines

Presenting Author(s):

D'Mitri "J.R." Farthing ('17)

Other Authors:

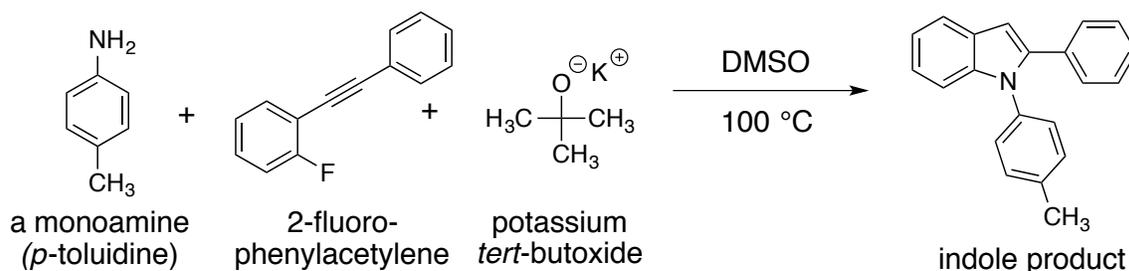
Reuben Hudson and Jeffrey Katz

Department:

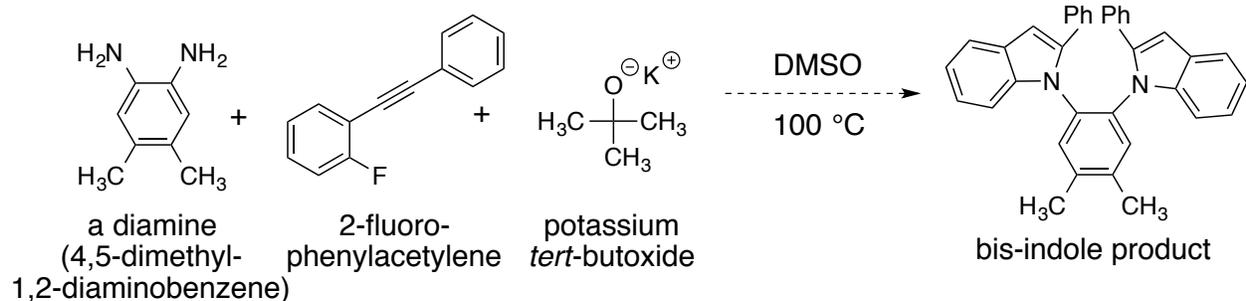
Department of Chemistry, Colby College, Waterville, ME

Abstract:

A major focus of the Katz group is to develop new organic chemical reactions. These new reactions in turn can enable the synthesis of molecules that are previously unknown or simplify the synthesis of highly complex molecules. We have already demonstrated that amines react with 2-fluoro-phenylacetylenes to produce indoles via a tandem acetylene-activated aromatic substitution–anionic cyclization sequence (Equation 1).¹ Indoles are highly sought after as pharmaceutical agents, and this reaction represents an efficient access to indole-containing compounds. My project is to investigate whether diamines can be used as the nucleophile in this same substitution-cyclization sequence (Equation 2). If this type of reaction is feasible, then I will use this knowledge to design the synthesis of highly complex, multi-indole compounds.



Eq



Eq

1) Bizier, N. P.; Wackerly, J. W.; Braunstein, E. D.; Zhang, M.; Nodder, S. T.; Carlin, S. M.; Katz, J. L. *J. Org. Chem.* **2013**, 78, 5987-5998.

Session ID:

P-8

Abstract Title:

Understanding the Circumstances and Effective Pedagogies for Multilingual and L2 Learners at Colby

Presenting Author(s):

Other Authors:

Andrew Finn ('16)

Stacey Sheriff

Department:

Department of English, Colby College, Waterville, ME

Abstract:

The percentage of L2 students in U.S. higher education has been steadily increasing for the past decade, and Colby is no exception. The number of Colby students for whom English is not a native language or who come from countries where English is not an official language is rising each year. International students comprised 12.0% of Colby's student body in 2011, 12.9% in 2012, and 15.3% in 2013. My project's purpose is to better understand what Colby professors and writing tutors can best do to serve these students in an academically rigorous learning environment dominated by Standard Academic English. This project addresses many aspects of Colby academics across all disciplines, as well as the Farnham Writers' Center, which sees far more L2 international students than any other demographic. We have been doing extensive research across a large number of academic writing, rhetoric, linguistic, and writing center journals to gather empirical data, case studies, and essays on L2 learners in U.S. higher education. Some of our goals are to create multilingual research resources for future writing center tutors, in the form of handouts and course materials, as well as useful annotated bibliographies and literature reviews for both students and faculty. We have found a plethora of relevant information and resources on general L2 pedagogy, history, cultural awareness, identity, tutoring, peer review, voice, language, writing organization and grammar, and notions of voice in academic writing. Our project will help Colby recognize the needs of L2 students in our institution, and provide guidance for most effectively addressing those needs in as many ways as possible.

Session ID:

P-9

Abstract Title:

The Testing Effect: A Tale of Two Experiments

Presenting Author(s):

Abby Fontaine ('15)

Other Authors:

Jennifer Coane

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

Do you get frustrated when you can't remember something from a class you took last semester? Or do you have trouble remembering information at test time? Luckily, research has demonstrated that repeated testing strongly supports long-term retention, while re-reading does not have the same positive impact (Butler, 2010; Chan, 2010; Karpicke & Roediger, 2007). This means that giving yourself a few quizzes before an exam will help you more than simply re-reading your notes. To examine the testing effect further, we conducted two experiments.

The first experiment examined the relationships among testing, spacing studying, and *working memory* (WM), our ability to remember information and use it in a short span of time. First, participants read four passages. Next, they were tested on one of the four passages and re-read a different passage. After a WM test, participants re-read another passage and were tested on the passage. Two days later, participants were tested on all passages and given two WM tests. We expect that participants with poor WM would receive a boost from effective study strategies such as testing and spacing, thus achieving test scores similar to those of participants with strong WM.

The second experiment investigated whether generating multiple choice questions from a passage would better prepare a participant for the multiple choice questions about that passage on the final test. Participants read three passages and then completed a different task after each one. After reading a passage, participants were asked to re-read it, generate multiple choice questions from it, or answer multiple choice questions about it. Two days later, participants were tested on all passages in an online survey including both multiple choice and short answer questions. We expect that participants who only re-read the passages would do worse than those participants who generated or answered questions.

Session ID:

P-10

Abstract

Investigations of Copper(I)-arene Complexes: Potential Differences Between Copper(I)-naphthyl Complexes

Presenting Author(s):

Maria Guerra ('16)

Other Authors:

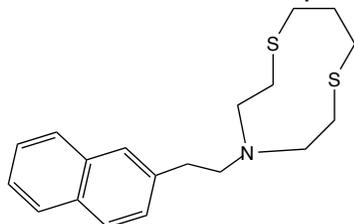
Thabiso Kunene ('15) and Rebecca Conry

Department:

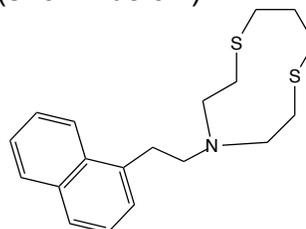
Department of Chemistry, Colby College, Waterville, ME

Abstract:

Copper(I)-arene complexes are sparingly used in organic synthesis, mainly because they are few in number and little is known about them. Therefore, in order to learn more about the reactivity and bonding features of these unique complexes, we are synthesizing copper(I)-naphthyl and-phenyl complexes. These particular copper(I)-arene complexes incorporate bonding between a neutral aromatic structure and the copper ion. The properties of such bonds are of particular interest to our lab. To make these complexes, the ligand must first be synthesized. These ligands have a macrocyclic ring containing a nitrogen atom and two sulfur atoms as bonding points, with either a naphthyl ethyl or phenyl ethyl group connected to the nitrogen atom. For the ligand that incorporates the naphthyl group, the arm connecting the group and the macrocyclic ring can be bound at either the one or two position of the naphthyl group (shown below).

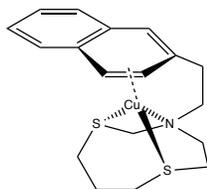


Ligand with arm in 2-position (Targeted ligand)



Ligand with arm in 1-position (Previously reported)

This project requires the synthesis of the 2-naphthyl ligand, which takes six steps. Then, inorganic techniques will be utilized, some in air-free environments, in two additional steps to add the copper ion to form the Cu (I) complex (shown below). I will then examine how the reactivity and characteristics of the bonding in this complex vary from the complex with the 1-naphthyl ligand using of methods such as nuclear magnetic resonance and infrared spectroscopy.



Copper(I)-naphthyl complex with arm in 2-position (Targeted)

Session ID:

P-11

Abstract

Remembering and Recognizing the MVP: The Invaluable Work of Black Women and Their Many Roles in the Pursuit of Freedom

Presenting Author(s):

Other Authors:

Tionna Haynes ('15)

Cheryl Townsend Gilkes

Department:

Department of Sociology, Colby College, Waterville, ME

Abstract:

This project encounters the various work black women did in slavery, the abolition of slavery and Reconstruction. A goal of this project is to remember black women and their importance in the black freedom narrative. Another goal is to recognize how invaluable their work was to the social, economic, and political fabric of slave communities and free black communities in defining of freedom (whether freedom meant becoming a wage earner, living without fear of whippings at the hands of white overseers, not being a slave anymore, exercising full citizenship, voting, or not experiencing racial discrimination was totally up to them).

In slavery, wartime, and Reconstruction, the labor of black women influenced the pursuit of freedom and efforts toward justice. Black women labored on multiple levels of life - on the plantation, at the home, on the battlefield, and at their work facilities. Their invaluable efforts must be acknowledged because, if it weren't for the women, the narrative of Africans and their descendants in America would be different. The foundational work done by enslaved women created the framework of values and labor that black women would continue to tap into through the Civil War, Reconstruction, and beyond.

By reading through scholarly work, we have come up with a list of roles, tasks, and situations that illuminate how black women were - like a Swiss army knife - multi-faceted and beneficial in many areas of life. This project allows us to look at the roles of black women in stratified slave and free communities and how they adapted to those conditions. For our institution, this project is an example of the depth of sociological research done at Colby. This project also emphasizes the importance of the African-American Studies program and the need to continue studying marginalized groups in America in post-secondary education.

Session ID:

P-12

Abstract Title:

Native Plant Community Screening on North Pond

Presenting Author(s):

Kiana Kawamura ('17) and Andrew Newcomb ('15)

Other Authors:

Russ Cole and Toni Pied

Department:

Department of Environmental Studies, Colby College, Waterville, ME

Abstract:

This study seeks to establish a baseline inventory of native aquatic plants in North Pond in the Belgrade Lakes Watershed of central Maine. Within this watershed are Great Pond and Messalonskee Lake, both of which have confirmed infestations of invasive variable leaf water milfoil (*Myriophyllum heterophyllum*). Therefore it is important for the rest of the watershed to be surveyed in detail, and native plant communities documented. This survey serves to screen for invasive aquatic plants, as well as to record the present state of the lake so that the potential impact of invasive plants may be measured. We conducted a two-person, boat-based survey for the Belgrade Regional Conservation Alliance (BRCA) and Colby College. Surveys were primarily visual – employing aqua scopes and masks and snorkels. Random samples in deeper parts of the lakes were taken using devices called Weed Weasels. Surveys were limited to the littoral zone. Littoral zones were divided into numbered grids and a Volunteer Lake Monitoring Program (VLMP) survey form was filled out for each area. Within North Pond much of the littoral zone was sandy or rocky and dominated by aquatic moss, immature pipewort, bayonet rush or pickerel weed. In areas close to bogs the substrate was muckier and dominated by bladderworts, aquatic moss, and spadderocks lilies. No invasive aquatic plants were found in North Pond.

Session ID:

P-13

Abstract Title:

The Value of Riparian Forests to the Community

Presenting Author(s):

Other Authors:

Gilbert Kiggundu ('15)

Sahan Dissanayake

Department:

Department of Economics, Colby College, Waterville, ME

Abstract:

Thermal pollution, the degradation of water quality due to the change in water temperature, is increasingly seen as a pollutant that can have a significant impact on the local ecosystem. Increases in water temperature can lead to a decrease in the oxygen levels which can kill indigenous aquatic species, change the ecosystem composition and lead to invasion by thermophilic species (Kennish 1992, Laws 2000). One solution available to policy makers is the creation of water cooling systems, but this can be expensive to build, operate and maintain. An alternative solution that has recently garnered interest is the use of riparian forest buffers to provide tree shade to naturally reduce the thermal pollution. Oregon currently has a shade credit program that is enforced by Clean Water Services in association with several partners who plant native trees and shrubs along the Tualatin River and its tributaries. In addition to helping CWS achieve its cooling targets the riparian vegetation helps to improve the air quality, improve the water quality by acting as filters, improve the quality of fish and wildlife within the area, and provides hiking and fishing habitat. In this study we use a choice experiment survey to understand the public's willingness to pay for the additional ecosystem services generated by these riparian plantings. The respondents were randomly selected and each respondent answered 12 choice questions. Preliminary results indicate that there is increased willingness to pay for the water quality, air quality and preservation of the fish and wildlife in the Basin. We find that that people's willingness to pay is significantly higher for preservation of fish and wildlife over the other attributes. The results show that this program has value beyond the reduction of thermal pollution and that these values should be considered when evaluating the effectiveness of the program.

Session ID:

P-14

Abstract Title:

Structural, Spectroscopic, and Theoretical Investigation of Twisted Phenanthrenes

Presenting Author(s):

Nicholas Kim ('16)

Other Authors:

Megan Hooper and Dasan Thamattoor

Department:

Department of Chemistry, Colby College, Waterville, ME

Abstract:

This work describes our progress toward the synthesis of twisted phenanthrenes (Fig. 1), which have potentially interesting structures and spectroscopic properties. In particular, the presence of certain substituent groups (R^1 and R^2) in the 4 and 5 positions, causes crowding within the bay area of the molecule, and forces the otherwise planar arrangement of the three fused benzene rings to twist. The synthesis of these molecules by photochemical methods and the investigation of their structure by X-ray crystallography are currently underway. So far, the phenanthrene precursor, diphenyl ethene, has been made from the Wittig reaction between benzaldehyde and phosphonium salt.

These compounds are also anticipated to display unusual spectral properties, especially by nuclear magnetic resonance spectroscopy, which will be investigated experimentally and by modern computational methods. Successful completion of the project will provide useful insights into structure and bonding in organic molecules, and the use of spectroscopy to diagnose unusual molecular properties.

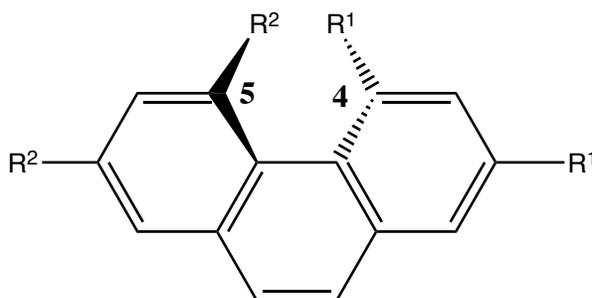
 $R^1 = \text{CH}_3; -\text{C}(\text{CH}_3)_3$ $R^2 = \text{Ph}; -\text{C}(\text{CH}_3)_3$

Figure 1. Phenanthrene

Session ID:

P-15

Abstract Title:

Cross-linker Method of Identifying Inter-membrane Protein Interactions

Presenting Author(s):

Adam Lavertu ('16)

Other Authors:

Alex Plesa ('17) and Ronald Peck

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Inter-membrane proteins play vital roles in both basic and complex cellular functions. Further clarification of their interactions would lead to new treatments and better understanding of diseases. During the research process I have learned how to perform Western blots, transformations and plasmid cloning. All of these techniques will prove very useful in my future research endeavors. Inter-membrane proteins have proven difficult to study due to their location within the lipid bilayer of the cell membrane. *Halobacterium salinarium* contains two membrane bound proteins lycopene elongase (Lye) and bacterioopsin, and we are testing to see whether these two proteins interact. Two new strains of *H. salinarium* were constructed, one with a modified bacterioopsin gene (*bop*) to encode a histidine tag on the C terminus. The other with a modified Lye gene, which attaches an epitope tag to the end of the Lye protein. A cross-linker made up of formaldehyde would bind to bacterioopsin and any other proteins in proximity to it. If Lye and bacterioopsin interact then they should be close enough together within the membrane to be bound together, and if they are close they likely interact. So far with the help of Professor Peck, I have created new plasmids containing the histidine tagged *bop* which can be used as a vector to insert a histidine-tagged *bop* into any strain of *H. salinarium* and possibly other organisms with a similar *bop* gene. I've worked on developing a control for the immunoblot screening process. I've also been conducting a phylogenetic analysis to investigate possible co-evolution of the two proteins.

Session ID:

P-16

Abstract Title:

Behavioral Responses to Ethanol in Circadian Rhythm Defective *Drosophila period* Mutants

Presenting Author(s):

DaWon Lee ('17)

Other Authors:

Yun Soo Park ('16) and S. Tariq Ahmad

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Circadian rhythm is the internal sleep/wake cycle that controls many physiological processes, including metabolic activity in humans and *Drosophila*. *Drosophila* circadian period is maintained in a 24-hour cycle with peak activity at dawn and dusk. Mutations in circadian pacemaker gene, *period*, results in flies with arrhythmic (*per⁰*), shorter (*per^S*), and longer (*per^L*) periods than wild type flies. Exposure to ethanol causes behavioral responses such as sedation and tolerance in humans and flies. However, exposure to ethanol also causes disruptions in circadian period. Therefore, behavioral effect of ethanol may differ due to variations in circadian period. In this study, all flies were maintained at 12 hour light/12 hour dark regimen with lights on/off transition at 6 am and 6 pm. The sedation time and tolerance were measured upon exposure to 100% ethanol vapors at a time of daily inactivity (11 am) and a time of daily peak activity (5 pm) in 1 day and 7 day old flies. Flies were determined to be sedated when they lacked the ability to upright themselves when given a physical disturbance. Preliminary data suggests that *per^L* flies have the longest sedation time and lowest tolerance. All strains show no difference in sedation time and tolerance between 11 am and 5 pm. The age dependent effect on sedation time and tolerance is currently being analyzed. This study will further improve understanding of correlations between ethanol intoxication and circadian rhythm.

Session ID:

P-17

Abstract Title:

Blooming Prospects from the Analyses of Phytoplankton in the Belgrade Lakes

Presenting Author(s):

Other Authors:

Janice Liang ('16) and George Voigt ('17)

Cathy Bevier and F. Russell Cole

Department:

Departments of Environmental Studies and Biology, Colby College, Waterville, ME

Abstract:

Residential development along lake shorelines can potentially influence dynamics of the entire lake ecosystem. One essential component, the functional base of the food chain, is phytoplankton. These photosynthetic protists contribute to primary production and depend on nutrients and light to grow. Phosphorous is one important nutrient, but levels can become excessive with too much human activity and result in blooms of algae. Maine's lakes are important to maintain as healthy and attractive ecosystems not only for aesthetic and economic reasons, but also for the ecological value that the lakes provide. Using FlowCAM[®] technology, we are analyzing phytoplankton communities in Great Pond and East Pond to monitor spatial and temporal changes in phytoplankton densities. We are looking for the differences in phytoplankton abundance and diversity between these two lakes, which have different trophic states: Great Pond is oligotrophic, while East Pond is more eutrophic and shallow. Based on general lake ecology models, we predict greater densities of phytoplankton in East Pond than Great Pond.

Another goal is to compare chlorophyll measurements from Colby's high-frequency monitoring buoy in Great Pond, affectionately known as "Goldie," to phytoplankton densities in water samples taken at the buoy and other sites around the lake. Preliminary data suggest a relationship between the chlorophyll content and phytoplankton abundances in the lake, which helps confirm the values collected by the buoy. We are also identifying and classifying the phytoplankton to determine if specific species contribute to spikes of chlorophyll throughout the summer. This work will provide key insights to the relationships between different species of phytoplankton and lake water quality, and potentially signify which species are indicators of worsening lake health.

Session ID:

P-18

Abstract Title:

Ethiopian Orthodox Church Forests Provide Hydrological Ecosystem Services: Evidence From Stream Sediment and Aquatic Insect Analyses

Presenting Author(s):

Sara LoTempio ('16)

Other Authors:

Travis Reynolds

Department:

Department of Environmental Studies, Colby College, Waterville, ME

Abstract:

In northern Ethiopia there are over 7,800 Ethiopian Orthodox "church forests", small groves of native Afromontane forests surrounding church buildings, and in many cases these forests represent the only stands of native tree in the midst of vast degraded agricultural landscapes. Studies of church forests to date have explored major ecological determinants of forest composition as well as key drivers of church forest degradation. However, the potential hydrological services provided by church forests remain to be studied. We tested the effect of church forest presence on water sediment loads and macroinvertebrate abundance and biodiversity in six streams flowing from open agricultural land through or alongside church forest groves in Amhara, Ethiopia. We collected water and aquatic insect samples from sites upstream of church forests, within or alongside church forests, and downstream of church forests, and compared sediment content (inorganic and organic) and macroinvertebrate community indices to assess the potential contributions of church forests to downstream water quality. Total suspended solids (TSS) upstream of church forests averaged 0.29 g l⁻¹, but upon entering a church forest, average TSS dropped to 0.19 g l⁻¹. Upon leaving the church forest, streams quickly responded to surrounding land uses and returned to relatively high TSS levels within 250m outside the forest. Nevertheless, streams do appear to respond to the protection afforded by natural forest cover in Ethiopian church forests. Preliminary analyses of macroinvertebrates in these same streams revealed high diversity in streams passing within the church forest sites, while stress-tolerant species including *Chironomids* dominated both upstream and downstream sampling sites. The findings of this research showcase the potential for church forest ecosystems to contribute to stream health, suggesting these small forest patches might be incorporated into broader regional watershed conservation strategies in northern Ethiopia.

Session ID:

P-19

Abstract Title:

Hidden in Plain Sight: The Muslim Legacy on African American Christianity

Presenting Author(s):

Papa Loum ('15)

Other Authors:

Cheryl Townsend Gilkes

Department:

Departments of Sociology and African American Studies, Colby College, Waterville, ME

Abstract:

Today, Islam is one of the fastest-growing religions in the United States despite a contemporary post 9/11 era marked by a rampant sentiment of islamophobia. African American communities constitute one of the principal sources of Islam's growth in the U.S. From African slaves to Malcom X, Islam has profoundly influenced African American culture and religion.

My research examines the role African Muslims who were made slaves in America played in shaping Afro-Christian traditions. In popular culture, people usually overlook the fact that 10 to 18% of the Africans who were made slaves in North America were Muslim. The majority of African slaves came from West Africa, a region that had been in constant dialogue with Islam for several centuries. African Muslims came with invaluable cultural toolkits that made them more influential than what their numbers would suggest.

I undertook a comparative study of relevant Biblical and Koranic verses in order to grasp the cultural heritage transmitted by those two Books which serve as reference guides to Christians and Muslims, respectively. The methodology used also focuses on a meticulous analysis of relevant historical figures such as Bilali Muhammad, an enslaved African Muslim whose descendants founded the First African Baptist Church of Georgia. The preliminary findings suggest that strong Islamic elements appear in Negro spirituals, congregational rituals, and religious literacy.

The portrayal of Islam as a recent foreign intrusion in the United States may be the result of many historians' reluctance to acknowledge the success enslaved African Muslims had in preserving their faith in a hostile environment of servitude. Hidden in plain sight, the contributions of African Muslims to American culture and their cohabitation with fellow enslaved Christians prove, if need be, the magic of cultural survival.

Session ID:

P-20

Abstract Title:

Restoration of Historical Fisheries and Ecosystem Services: Alewife
Fisheries in Maine

Presenting Author(s):

Samantha Lovell ('16) and Caroline Keaveney ('15)

Other Authors:

Loren McClenachan

Department:

Department of Environmental Studies, Colby College, Waterville, ME

Abstract:

In Maine (USA) dam removal and other ecosystem restoration efforts have resulted in increases in coastal and anadromous fish populations. This research investigates the suite of social and economic benefits conferred by the restoration of habitat connectivity and historical fish populations. By interviewing town clerks, fish agents, harvesters, and other stakeholders in the 17 towns with active alewife harvests, we hope to quantify the value derived from restored fisheries, identify social benefits from community building around fisheries restoration, highlight legal opportunities and challenges to restore historical community fishing rights, and investigate strategies for local and customary management. Maine is a leader in active habitat-based anadromous fisheries restoration, but many other regions are considering similar restoration; this research provides a structure for assessing the social benefits of such restoration projects.

Session ID:

P-21

Abstract Title:

The Effect of Phosphorylation on the Ability of Transcription Factor TaABF1 to Regulate *HVA1* Gene Expression in Cereal Seeds

Presenting Author(s):

Justin Lutian ('15) and Xi Yang ('16)

Other Authors:

Russell Johnson

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

The hormones gibberellin (GA) and abscisic acid (ABA) regulate many important aspects of plant physiology, including seed development and germination. The wheat transcription factor TaABF1 plays a crucial role in the intersecting signaling pathways of GA and ABA. Specifically, TaABF1 mediates ABA-induced expression of the *HVA1* gene under stress conditions, such as drought and increased salinity. Past studies have shown that many transcription factors are activated by the phosphorylation of one or more serines in their protein sequences. Since TaABF1 contains serines that could be phosphorylated, we tested the effect of changing the phosphorylation state of TaABF1 on its ability to regulate *HVA1* expression. To do so, we produced mutant TaABF1 constructs substituting aspartate, which mimics a phosphorylated serine, and alanine, which cannot be phosphorylated, for specific serines within TaABF1. Through particle bombardment with a gene gun, plasmids containing these DNA mutants were introduced into the nuclei of aleurone cells in seeds and were expressed during incubation. We found that the simultaneous mutation of four serines in two different regions of TaABF1 to aspartates markedly increased *HVA1* expression. Also, a single mutation of serine-37 to aspartate significantly contributed to the overall up-regulation of *HVA1* expression. Our results suggest that serine phosphorylation enhances TaABF1's ability to stimulate expression of *HVA1* and is a likely mechanism by which TaABF1 is activated.

Session ID:

P-22

Abstract Title:

Assessing Sustainability at Colby College: Implementing a Rating System to Benchmark and Improve the College's Environmental Efforts

Presenting Author(s):

Jeffrey Meltzer ('15)

Other Authors:

Kevin Bright

Department:

Office of Sustainability, Colby College, Waterville, ME

Abstract:

My primary task as the assistant in the Office of Sustainability this summer is to complete and submit Colby's entry to STARS, the Sustainability Tracking, Assessment & Rating System. STARS, led by the Association for the Advancement of Sustainability in Higher Education (AASHE), allows colleges and universities to gauge their progress towards sustainability. In our last submission we received a silver rating but are hoping to receive a gold rating with this entry. Preparing our STARS submission required research into the inner-workings of the College as well as interviews with several different stakeholders to learn about Colby's sustainability with regards to our academics, engagement, operations, planning, and administration. While completing our STARS submission, I found many areas where Colby could improve its sustainability methods and addressed several of them.

Three of the many projects I completed this summer were to evaluate the benefits of switching to electric hand dryers; creating a commuter survey to learn more about how students, faculty, and staff commute to the College; and creating and implementing an environmental literacy survey for incoming first-years and graduating seniors. I found that high-speed, energy-efficient hand dryers are significantly more efficient economically and environmentally beneficial than paper towels and that the payback period for switching to electric dryers is less than a year and a half. When evaluating the carbon emissions inventory of the College, I learned that we make several outdated assumptions. Hopefully by gaining a more accurate portrayal of commuter travel—accounting for people who carpool, walk, or bicycle—we will be able to encourage more sustainable commuting. With regards to the eco-literacy survey, by creating a way to monitor the environmental knowledge of Colby students, we will be able to assess and improve environmental awareness at Colby, and ideally ensure those who graduate are “eco-literate.”

Session ID:

P-23

Abstract Title:

Not So Natural Disasters

Presenting Author(s):

Melissa Meyer ('16)

Other Authors:

Paul Josephson

Department:

Department of History, Colby College, Waterville, ME

Abstract:

This project examines major disasters as the Fukushima Nuclear Accident (in comparison with Chernobyl); the Bhopal Chemical disaster; the Exxon Valdez and Deep Water Ocean spills; and the Katrina and Sandy Hurricanes. These disasters require consideration of the term "man-made." Disasters require the interactions between human, nature, and technology. Particularly, they often have disproportionate impacts on poor people, workers and their families, indigenous people, women and children. This research examines these impacts and their treatment in the media, when public officials, scientists, and corporate executives come to grips with the unfolding crisis. It considers political and engineering concerns, health and human rights, environmental impacts, and social issues.

Preliminary research indicates that human interaction with nature changed significantly because of industrialization and globalization. Humans celebrate technological advances, yet these advances parallel the growing risk of catastrophe. Most people overlook this, instead anthropomorphizing nature and calling it harmful, destructive, and capricious. Humans encourage improvements on nature, for example, engineering a river for storage, hydroelectric, flood control, and irrigation purposes, or building up to the coastline. However, these activities often leave residents more vulnerable when hurricanes or floods occur (Katrina). Human obeisance to a fossil fuel economy, profit-minded corporations working with well-connected politicians create unsafe, industrial structures (Bhopal, Exxon Valdez). On top of this, media has naturalized the horrors of disasters and obfuscated the essence of "natural disasters." Without ever experiencing accidents first hand, most people now visualize disaster phenomena through a screen and feel sentimental pity for those who suffer from a comfortable distance away from the actual event, and in so doing, lose sight of its political, economic, and cultural roots. Instead of praising nature for its vitality and renewal, humans are overwhelmed, anxious, and lost by the way nature disrupts man-made control and order.

Session ID:

P-24

Abstract Title:

To Drink or Not to Drink: Which High School Abstainers Become Heavy Episodic Drinkers During the First Semester of College?

Presenting Author(s):

Caroline Minott ('16)

Other Authors:

Allecia Reid McCarthy

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

High-risk binge drinking on college campuses is a great concern. Binge drinking is associated with many consequences - including academic problems, sexual assault, and over 1,800 unintentional deaths annually. To form safer college campuses, it is important to reduce these negative consequences. Our research is exciting because it aims to understand both factors that promote heavy drinking and factors that predict the effectiveness of alcohol interventions for college students. Many U.S. institutions have adopted web-based alcohol intervention programs, such as AlcoholEdu, for incoming students to complete before coming to campus. As a part of AlcoholEdu, students respond to three surveys. Surveys 1 and 2 occur prior to matriculation; survey 3 occurs 4 weeks into the fall semester. Each survey assesses a range of variables related to alcohol use. Therefore, AlcoholEdu provides both an intervention and descriptive data for a college on their incoming students. In my project, I used Colby's AlcoholEdu data collected from incoming students, 2008-2013. I examined whether pre-matriculation demographic variables and psychological factors predicted which high school abstainers transitioned into heavy episodic drinking during their first semester of college. Data analyses revealed that, of the 793 high school abstainers from years 2008-2013, 10% became heavy episodic drinkers in their first semester of college. Individual correlations indicated that eight demographic factors and five psychological factors significantly predicted this behavior. Demographic predictors included U.S. citizenship and athletic involvement; protective factors included substance-free living and religious group affiliation. In a combined analysis of all significant factors, only psychological factors emerged as significant predictors of transitioning into heavy drinking: higher expectations for positive social outcomes, lower expectations for experiencing consequences, and having fewer reasons to abstain. These findings indicate that addressing psychological factors before students come to campus may reduce heavy drinking rates among students nationwide, as well as at Colby.

Session ID:

P-25

Abstract Title:

Characterization of Alternations in Circadian Rhythm in a Rotenone Induced Parkinson's Disease Model of *Drosophila*

Presenting Author(s):

Yun Soo Park ('16)

Other Authors:

DaWon Lee ('17) and S. Tariq Ahmad

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Parkinson's disease (PD) is a neurodegenerative disorder characterized by selective degeneration of dopaminergic neurons of substantia nigra pars compacta. The symptoms of PD include movement rigidity, postural instability, and disruptions in the sleep-wake cycle. Rotenone is a commonly used pesticide that causes mitochondrial dysfunction, leading to oxidative damage mediated cell death. Previous studies report that rotenone also causes locomotor deficits similar to the symptoms of PD. Here, we studied the circadian rhythm in the rotenone-induced *Drosophila* model of PD. Circadian rhythm is defined as the innate daily 24hr sleep-wake cycle in humans and *Drosophila*. Wild type *Drosophila* raised on 125 μ M and 250 μ M of rotenone-supplemented food were initially entrained in 12hr light/12hr dark (LD) phase for 3 days. The free-running locomotor period- the duration between daily onset of locomotor activity when maintained in 24hr dark-dark (DD) phase- was observed for 7 days. In addition, we investigated if flies with circadian disorders are more vulnerable to rotenone by observing the free-running locomotor period of *period(per)* mutant flies that show shorter (*perS*) and longer (*perL*) free-running locomotor periods than wild-type flies. Preliminary data suggests that there is no significant effect of rotenone on the free-running locomotor period of the wild-type flies. The effects of rotenone on *per* mutant flies are currently being investigated. This study will enhance understanding of circadian deficits in rotenone-induced *Drosophila* model of PD.

Session ID:

P-26

Abstract

Jadera haematoloma Wing Development and Dimorphism

Presenting Author:

Other Authors:

Mary Parks ('16)

David Angelini

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

The soapberry bug, *Jadera haematoloma*, is a species of true bug that exhibits a unique form of wing dimorphism that results in two distinct phenotypes: long and short wings. *J. haematoloma* that develop longer wings are able to fly whereas those that develop short wings are able to reproduce larger numbers of offspring. Understanding the genetic and environmental mechanisms for dimorphism in the wing development of *J. haematoloma* would shed light on the species development as well as ecological implications for its current range expansion. Allometry is the regulation of organ size in relation to body size. Our research examines allometric wing size in both *J. haematoloma* and another true bug species *Oncopeltus fasciatus*. *O. fasciatus* only exhibit a long-winged monomorphic phenotype, and their similar wing development is useful for comparison to *J. haematoloma*. To investigate wing dimorphism, we have used RNA interference (RNAi) to knock down the function of specific genes within the organisms. One gene we have examined using RNAi is the Forkhead box protein, FoxO, a negative regulator of the insulin receptor [1]. Experiments knocking out FoxO during juvenile development resulted in statistically significant differences between the occurrence of long winged and short winged *J. haematoloma* adults. We have also started to perform RNAi targeting the Insulin Receptor genes, which may also influence wing phenotypes in *J. haematoloma*. Environmental influences such as nutrition may also be significant factor in development and growth of wings in the soapberry bug [2], and future experiments will involve nutrition trials to test this influence.

Sources:

[1] Barthel, Andreas, Dieter Schmolli, and Terry G. Unterman. "FoxO Proteins in Insulin Action and Metabolism." *Trends in Endocrinology & Metabolism* 16.4 (2005): 183-89. Web. 7 July 2014.

[2] Carroll, Scott et. al. "Evolution of Cryptic Flight Morph and Life History Differences During Host Race Radiation in the Soapberry Bug, *Jadera haematoloma* Herrich-Schaeffer (Hemiptera: Rhopalidae)." *Ann. Entomol. Soc. Am.* 96(2): 135-143 (2003).

Session ID:

P-27

Abstract Title:

Development of the Split-SAMP System for Identifying Transmembrane Protein Interactions

Presenting Author(s):

Alex Plesa ('17)

Other Authors:

Adam Lavertu ('16) and Ronald Peck

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Cell membranes are very important for the regulation of the cell's internal conditions. As a result, the proteins that reside inside these membranes are crucial for the well functioning of the organism. For example, the halophilic *Halobacterium salinarum* contains the protein bacteriorhodopsin, which provides the cell with energy by converting light into chemical energy. We set to develop a novel mechanism for studying bacteriorhodopsin's interactions with other transmembrane proteins in archaeal organisms using ubiquitin-like Small Archaeal Modifier Proteins (SAMPs).

These proteins have similar roles in protein modification as ubiquitins have in Eukarya. We planned to use these SAMPs to design two complementary polypeptides that would allow us to study the interactions of our proteins of interest. One of the peptides (the prey) would contain the first protein of interest and the N-terminus part of SAMP, and the other peptide (the bait) would contain the second protein of interest, the C-terminus part of SAMP, and a transcription factor TF. If the two transmembrane proteins of interest interact with each other, the two SAMP parts will interact in the cytoplasm, triggering the cleavage of the transcription factor by a protease. Furthermore, the TF will bind to the chromosome and start the transcription of a gene that will have a specific quantifiable effect. In our case, the gene encodes the Green Fluorescent Protein. We can then quantify the interaction between the two proteins by measuring the fluorescence of the archaeal cultures.

So far, we have designed the synthetic genes that we are going to use to create the prey and the bait. Since we know that *Halobacterium salinarum* bacteriorhodopsin interacts with itself across the membrane, we have chosen this protein for both parts of the SAMP to test our mechanism with.

Session ID:

P-28

Abstract Title:

Extreme Environments Hiding in Our Backyards

Presenting Author(s):

Mark Ravichandran¹ ('16)

Other Authors:

David Emerson², Jade Enright¹ ('15), and D. Whitney King¹

Department:

(1) Department of Chemistry, Colby College, Waterville, Maine, (2) Bigelow Institute for Ocean Sciences, East Boothbay Harbor, Maine

Abstract:

Hydrogen peroxide (HOOH) is a reactive oxygen species commonly produced in the atmosphere and the surface waters by indirect photochemical reactions. This photochemically produced transient species plays a role in the oxidation of metals and dissolved organic materials in the ocean and lakes. At very high concentrations (3%) HOOH is a common disinfectant used to kill bacteria in human skin abrasions. This work documents natural HOOH concentrations in iron rich seeps hundreds of times higher than previously observed in the environment. These iron seeps are generally small (50 square meters) but remarkably common in Central Maine. Seeps are formed when anoxic ground water carries ferrous iron to the earth surface where it comes in contact with oxygen and iron oxidizing bacteria such as gallionella and leptothrix. These forms of bacteria can be identified by the iron oxides formed and their shape; stalks and sheaths are indicative of gallionella and leptothrix respectively while more general and amorphous groups of iron oxides indicate other strains of iron-oxidizing bacteria. It is well documented that the iron bacteria grow on the chemical energy released by iron oxidation. The elevated hydrogen peroxide is more surprising because the peroxide is concentrated enough to greatly hinder the growth of many forms of bacteria, fungi, parasites, and more. We report HOOH results from iron seeps in Waterville and Boothbay, Maine and speculate that specific bacteria namely gallionella and leptothrix have evolved to thrive in these hostile chemical environments by extracting energy from iron oxidation without competition from the "neighbors". In Quarry Road site specifically, iron oxidizing bacteria have learned to survive at very extreme pH levels.

Session ID:

P-29

Abstract Title:

DNA Damage *in Vivo*: Cell-killing Potential of Nitrogen Mustard, an Anti-cancer Drug

Presenting Author(s):

Samuel Redstone ('15)

Other Authors:

Julie Millard

Department:

Department of Chemistry, Colby College, Waterville, ME

Abstract:

This goal of this project is to study the toxicity of the anti-cancer agent nitrogen mustard (Figure 1, below) to human promyelocytic leukemia (HL-60) cells to determine its median lethal dose (LD₅₀): the drug dosage at which half of the cells are killed off over a given time interval. Previous studies to find its LD₅₀ value yielded inconsistent results; therefore we are also trying to conclude whether the solvent used to dissolve the nitrogen mustard affects its cell-killing potential. Drug treatments are prepared by dissolving the compound in 0.1% (v/v) DMSO, 0.1 mM HCl, or a combination of both, and diluting the stock solutions to their desired concentrations before they are administered to the HL-60 cells. Following a 12- or 24-hour incubation period, the percentage of living cells is calculated using the MTT Cell Proliferation Assay, a colorimetric test that uses the production of a purple dye by metabolically active cells to determine the ratio of respiring cells to non-living cells. The ultimate goal of this research is to compare the cell-killing potential of nitrogen mustard to structurally related compounds in order to test the hypothesis that the drug acts by forming interstrand cross-links in DNA.

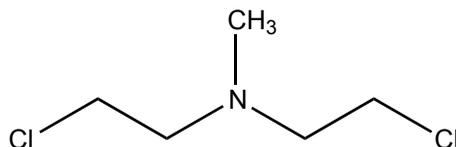


Figure 1: Nitrogen Mustard.

Session ID:

P-30

Abstract title:

Investigating the Properties of Difluoroboron Diketone Functional Groups in a Macrocycle

Presenting Author(s):

Vivek Sah ('17)

Other Authors:

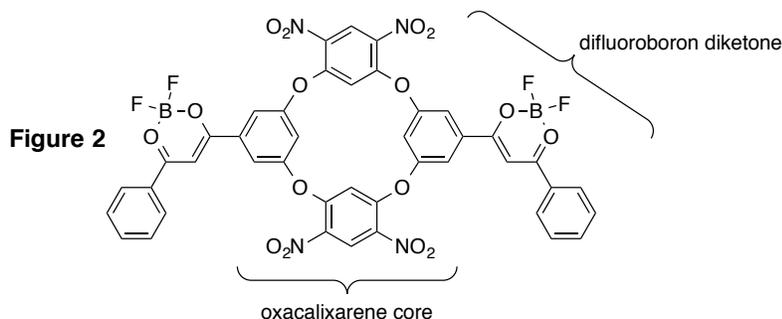
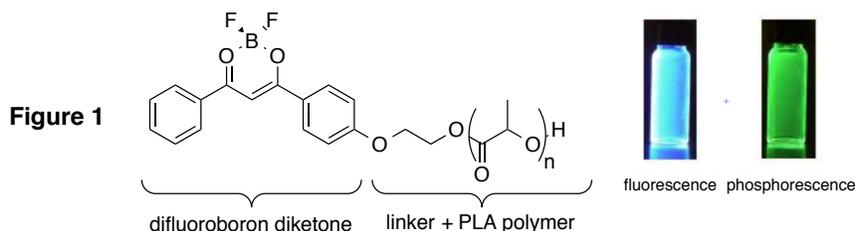
Jeffrey Katz

Department:

Department of Chemistry, Colby College, Waterville, ME

Abstract:

Difluoroboron diketone complexes are highly luminescent and have been shown to exhibit different fluorescence and phosphorescence properties in different environments. For example, when bound to polylactic acid (PLA), temperature-sensitive fluorescence and oxygen-sensitive room-temperature phosphorescence can be observed, the latter of which can make the materials applicable for *in vivo* oxygen-level sensing and as tumor imaging agents (Figure 1).¹ We in the Katz group work with macrocyclic molecules called oxacalixarenes (Figure 2). My project is to investigate the synthesis of oxacalixarenes containing difluoroboron diketones. The oxacalixarene will act as a molecular scaffold to position two difluoroboron diketones in different orientations, and I will study how this affects their luminescence properties.



1) G. Zhang, J. Chen, S. J. Payne, S. E. Kooi, J. N. Demas, and C. L. Fraser *J. Am Chem. Soc.* **2007**, *129*, 8942-8943.

Session ID:

P-31

Abstract Title:

LakeSmart Revisited

Presenting Author(s):

Stephen O'Grady ('16) and Anne Schechner ('15)

Other Authors:

Janice Liang ('16), George Voigt ('17), Cathy Bevier, and Russell Cole

Department:

Departments of Biology and Environmental Studies, Colby College, Waterville, ME

Abstract:

Residential shoreline development on lakes has been linked to nutrient and sediment loading, potentially causing accelerated eutrophication that affects lake water quality and overall ecosystem health. However, if development proceeds using best management practices, such as maintaining an effective buffer strip between a house and the shore, runoff, erosion, and nutrient-loading can be minimized. Maine's Mandatory Shoreland Zoning Act, first enacted in 1971, provides important environmental regulations that encourage responsible development. Lakesmart is a more recent program, initiated state-wide by the Department of Environmental Protection in 2004. It is currently run by the Maine Lakes Society with goals that include educating and recognizing homeowners interested in managing their property in ways that protect lake water quality. Results of previous research by Colby students and faculty demonstrates that properties with vegetated buffers have characteristics in the riparian and littoral habitats that are not significantly different from those of undeveloped, or reference, properties. This suggests that shoreland areas can indeed be developed in environmentally-friendly ways that mimic the natural landscaping. This summer we are surveying LakeSmart award-winning properties along East, Great, and Long Pond of the Belgrade Lakes region to compare the same set of habitat characteristics to those of previously examined buffered properties. One goal is to assess the effectiveness of the LakeSmart program in terms of encouraging lake-friendly landscaping. Criteria being evaluated in the riparian zone include aspects of tree cover, shrub cover, vegetation composition and density, and potential for erosion. In the littoral zone, we are exploring sediment type, the prevalence of leaf litter and woody debris, and the embeddedness of rocks in sediment. We are comparing the site profiles to buffered properties from previous work to determine the effectiveness of the LakeSmart designation in terms of the riparian and littoral zone.

Session ID:

P-32

Abstract Title:

Characterization of the Major Guanosine Monoadducts Formed by Epichlorohydrin

Presenting Author(s):

Paul Scott ('16)

Other Authors:

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Abstract:

Epichlorohydrin (ECH, Figure 1) is a probable human carcinogen widely used in the synthetic polymer industry. Rats exposed by inhalation to this compound show an increased incidence of tumors of the nasal cavity, and exposed workers show a variety of ill effects. Previous work in our lab suggests that ECH reacts with deoxyguanosine to form both monoadducts and interstrand cross-links. Because the compound has two reactive groups, an epoxide and chloride, it can react to form two possible monoadducts (Figure 2). The goal of this work is to determine which monoadduct is actually formed on the way to cross-links. We are reacting ECH with both pure guanosine and calf thymus DNA and characterizing the reaction products with a time-of-flight mass spectrometer (Agilent 6200 Series), which determines the mass of each product. The experimental masses are then checked against the predicted mass of each monoadduct. The presence or absence of the predicted mass patterns for each monoadduct can help to reveal the mechanism of cross-linking.

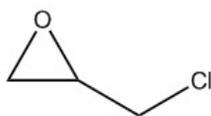


Figure 1: Epichlorohydrin

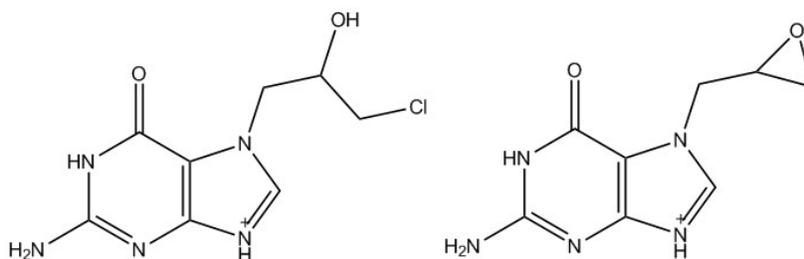


Figure 2: Possible monoadducts of ECH and guanosine

Session ID:

P-33

Abstract Title:

Galaxy Classifications Leading to an Understanding of Our Cosmic Origins

Presenting Author(s):

Jill Twist

Other Authors:

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Department:

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Abstract:

Galaxies are the largest building blocks in the universe. There are literally billions of galaxies beyond our own. It is through observations of galaxy structure that we learn about how galaxies form and evolve with time, thereby learning about our own cosmic origins. Three main galaxy types help with classifying the massive amount of galaxies. The disk galaxy type—which looks like our own Milky Way Galaxy—has active star formation, and contains younger, bluer stars. The spheroid galaxy type looks like a sphere, has redder light, and has no new stars forming. The irregular galaxy type is asymmetrical, lacks any well-defined structure, actively forms stars, and changes shape. By using state of the art images from the Hubble Space telescope, we performed visual classifications of galaxies that span across $\frac{3}{4}$ of cosmic time. These visual classifications include sorting galaxies into at least one of the three galaxy types, and flagging a number of other more detailed structural features. There are about 50 other classifiers from a number of different international research centers also working on this project, with the goal of classifying 50,000 galaxies. All of our classifications are done visually because computer algorithms are not yet precise enough to be able to accurately model all the details of varied galaxy structure. By having 50,000 galaxies classified by human eyes, there is an answer key of sorts to test computer programs. These classified galaxies will help others create better galaxy classification computer algorithms, which will provide even more classifications in the future. By increasing the number of classifications, we will be able to better understand galaxy structure and evolution, and our own cosmic origins.

Session ID:

P-34

Abstract Title:

Measuring Water Quality in the Great Pond

Presenting Author(s):

Caitlin Farrington, Grace Uwase, Denisha Daniels, Vianny Lugo, Tanvir Shahjahan, Niall Sefah, Katherine Hunt, Sandra Sanchez, Sonia Garcia, Marcus Jones, and Elissa Guerra

Other Authors:

CAPS5

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Abstract:

Great Pond serves as a recreation site and a significant economic engine for the surrounding community. In this project we monitored the oxygen levels in Great Pond in the Belgrade Lakes in order to establish the health of the lake. Low oxygen levels kills fish and other aquatic organisms that require oxygen to survive. Low oxygen levels in the deep water also releases phosphorus from lake sediments which can trigger algae blooms. We measured oxygen using three different analytical systems; Winkler titrations, a Clark electrode, and a new fluorescence based sensors on the buoy (Goldie). The three techniques use very different analytical methods, but produce remarkably consistent data. We will discuss the advantages and limitations of each method relative to our goal of monitoring lake health and communicating our results to a diverse audience of limnologists, conservation professionals, and shoreline property owners.

Session ID:

P-35

Abstract Title:

Historical Legacies and Participatory Democracy: Institution Building in Guatemala

Presenting Author(s):

Other Authors:

John Bengtson ('15)

Lindsay Mayka

Department:

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Abstract:

The third wave of democracy in Latin America brought a rush of transitions from authoritarian rule to democracy in some form. The question was no longer how to achieve democracy, but how to consolidate and improve it. It was in this context that many Latin American countries sought to address legitimacy issues by creating participatory policy making institutions to improve interest representation and public ownership of the government. Guatemala instituted a series of development councils with their liberalization and constitutional reform in 1986, but the quality of these councils leaves something to be desired. This project uses a framework developed by Professor Lindsay Mayka to assess the origins of participatory institutions and how those origins affect their ability to build effective and reinforcing patterns of behavior around participation. The project finds that Guatemala's system was hindered by pragmatic concerns on the part of its founders, who were concerned with negotiating a military led packed transition.

This project serves as an important case study in the current debate over the reformation of democracy in Latin America. In the context of the so-called Pink Tide and the return of neo-populists like Hugo Chavez, the direction and leaders of Latin American democracy is as important as ever. This project will use primary—interviews with architects and users of the system—as well as secondary evidence—the present composition of the councils to obtain a better understanding of their impact. The end goal will be to arrive at a better understanding of how Latin American democracies involve their constituencies, and how these efforts become successful, institutionalized, and meaningful.