CUSRR

6th Annual

Colby Undergraduate Summer Research Retreat

July 25th - 26th 2013

Crab Apple Whitewater

The Forks, ME

Colby College
4000 Mayflower Hill Road
Waterville, ME 04901
(800) 859-4000
web@colby.edu

July 25, 2013

To the participants of the 6th annual Colby Undergraduate Summer Research Retreat,

The organizers of CUSRR 2013 are delighted to have so many Colby students, faculty, administrators, and alumni at this year's event. Each year we relish in the opportunity to put this magnificent event together and anticipate that this will be the best CUSRR ever! We look forward to celebrating the wonderful accomplishments of Colby's amazing students as we wrap up another summer on Mayflower Hill.

We would like to thank Colby College, particularly President Adams and Dean Kletzer for their support of CUSRR. We would also like to thank Drs. Gregory Pomeroy ('81), William Koster ('66), and John Chahbazi for their generous contributions. Finally, we are grateful to our hosts, Crab Apple Whitewater, for helping to make this event possible.

Our best wishes for a fun and productive retreat!

The CUSRR Planning Committee

Kevin Rice
Melissa Glenn
Arne Koch
Ankeney Weitz
Paul Greenwood
Amy Poulin
D. Whitney King
Jeff Katz
Joe Reisert

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CUSRR 2013 Abstract Award Winners

In recognition of Drs. Gregory C. Pomeroy ('81), William H. Koster ('66), and John C. Chahbazi, whose generous gifts will help ensure CUSRR as a permanent fixture of the summer experience at Colby College, the CUSRR Planning Committee has established student awards in their names. Awardees are selected based on the quality and general audience accessibility of their submitted abstracts.

Dr. Gregory C. Pomeroy ('81), Keynote Speaker of CUSRR 2010, earned his M.D. from the Royal College of Surgeons in Ireland after graduating from Colby in 1981. Dr. Pomeroy is one of the most accomplished and respected foot and ankle surgeons in the country and enjoys surgical privileges at Mercy Hospital and Maine Medical Center. He is also an associate clinical professor of surgery on the staff of the University of New England.

The 2013 recipients of the "Gregory C. Pomeroy Award" are:

Josephine Liang and Anna Kronauer – Psychology (Abstract P-22)

Dr. William H. Koster ('66) distinguished himself over a 30-year career in the pharmaceutical industry as a scientist, senior executive, team builder, and leader. His professional positions have included Senior Vice President of Drug Discovery at Bristol Myers Squibb and President and CEO of Neurogen. He remains on the board of Neurogen and is now President and CEO of Northern Pilot Company, a firm that offers strategic guidance to the pharmaceutical industry. Dr. Koster is also a Colby College Overseer.

The 2013 recipient of the "William H. Koster Award" is:

Kate Connolly – History (Abstract P-5)

Dr. John C. Chahbazi has been practicing medicine since 1996 at the McLaren Family Medicine Residency in Flint, MI. He received his Bachelor's and medical degrees from the University of Michigan before completing a residency in family practice at the Naval Hospital in Charleston, SC and a fellowship at the University of North Carolina. Dr. Chahbazi is also a retired naval officer with a distinguished service record that includes the first Gulf War.

The 2013 recipient of the "John C. Chahbazi Award" is:

Omari Matthew – Biology (Abstract P-30)

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2013 CUSRR Keynote Speaker

Robert Hoopes, '89

President

VOX Global
Washington, DC

A native of Wilmington Delaware, Robert Hoopes graduated from Colby College in 1989 with a Government major. He went on to earn a Master's Degree in Legislative Affairs from George Washington University and an Honorary Master's Degree from Colby. Mr. Hoopes has been politically active for many years, serving on Joe Biden's 1987 presidential campaign and then in Biden's senate office. He has also worked in other senators' offices, political campaigns, and engaged in several other grassroots efforts. Mr. Hoopes is currently President of VOX Global, a DC-based public affairs firm and subsidiary of Omnicom, one of the world's largest communication firms. In addition, Mr. Hoopes regularly contributes to Fox News, NPR, MSNBC, BBC World News and The Huffington Post. He also serves on the Council of American Politics at the George Washington University, teaching as an adjunct professor at its Graduate School of Political Management.

Colby College and the organizers of the Colby Undergraduate Summer Research Retreat are honored to have Robert Hoopes as the Keynote Speaker of CUSRR 2013.

VOX Global

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Undergraduate Research Symposium – Thursday July 25th, 2013

8:30 AM – 9:20 AM **Symposium Registration** **Lobby**

9:20 AM – 9:25 AM **Opening Remarks** **Auditorium**

Lori Kletzer, Vice President of Academic Affairs and Dean of Faculty

9:25 AM – 9:35 AM **Introductory Remarks** **Auditorium**

Kevin Rice, Chair, CUSRR Planning Committee
Robert Peabody, Owner, Crab Apple Whitewater

9:35 AM – 12:00 PM **Morning Session** **Auditorium**

Co-chairs: Jeff Katz, Chemistry and Dr. Gregory Pomeroy, '81

9:35 AM Francesca Soriano, Art – *"The Print and Contemporary Printmaking"*

9:48 AM Kimara Nzamubona and Juan Morotti, Chemistry – *"Development of a Next Generation Field-Portable Iron Sensor in Natural Waters Using a Natural Occurring Siderophore Desferrioxamine-B"*

10:01 AM Ellen Evangelides, Environmental Studies – *"Sacrificing the Sacred: Land-Use Changes and Moral Shifts in Northern Ethiopian Church Forests"*

10:14 AM Natasha Ziv and Ariel Batallan, Psychology – *"BDNF and the Sad Rat Solution: The Search for "Blue" Genes*

10:27 AM Katie Daigle, Miller Special Collections – *"Prejudicial Preferences: The Discriminatory Selection Practices of Colby's Greek Letter Societies"*

10:40 AM ***BREAK***

10:55 AM	Arianna Porter, Biology – *"To Fertilize or Not To Fertilize: Assessing Trophic Complexity in a Rainforest Ecosystem"*
11:08 AM	Rhiannon Archer, Sociology – *"The Prevalence of Depression and Dual Diagnosis in a Mental Health and Substance Abuse Treatment Center"*
11:21 AM	William Qualey, German and Russian – *"Cats in Akif Pirinçci's 1989 Novel, Felidae"*
11:34 AM	Connor McGuckin, Chemistry – *"Purification and Characterization of pRMG, a Novel Peptide that Binds Damaged DNA"*
11:47 AM	Indiana Jones, History – *"The History of Fear in the Ancient Mediterranean"*

12:00 PM – 1:00 PM Lunch Outdoor Patio

1:00 PM – 3:30 PM Afternoon Session Auditorium

Co-chairs: Erin Sheets, Psychology and Cheryl Townsend Gilkes, Sociology

1:00 PM	Ben Borchard and Stephen Morse, Computer Science – *"CPU Sim Redesign"*
1:13 PM	Xiaojie Chen and Lucy O'Keeffe, Economics – *"Life in the Belgrade Lakes Watershed"*
1:26 PM	Max Cushner, Chemistry – *"Towards the Synthesis of an Unreported Copper(I)-Naphthyl Complex"*
1:39 PM	Kelsey Park and Anna Rabasco, Psychology – *"The Best Years of Your Life? An Examination of Social Belonging in the Colby Community"*
1:52 PM	Kyle Laurita-Bonometti, Creative Writing – *"Taking a Stab at Murder Mystery"*
2:05 PM	***BREAK***
2:25 PM	Czarina Evangelista and Alexandra Brown, Psychology – *"Hey! Is that Choline in Your Pocket or Are You Just Happy to See Me? Exploring the Interactions of Dietary Choline and the Antidepressant Imipramine"*

2:38 PM	Pamela Alakai, French and Italian – *"Women's Struggles as Poets in 19th-century France"*
2:51 PM	Theresa Petzoldt and Becky Forgrave, Environmental Studies – *"Nutrient Limitation in the Belgrade Lakes Watershed"*
3:04 PM	Sam LeBlanc, Women's, Gender, and Sexuality Studies – *"Paradoxes in Pentecostalism: How Practitioners' Perceptions are Discontinuous with Reality"*
3:17 PM	Julia Rogers, Biology – *"The Effect of Fertilizer and Species Evenness on the Relative Growth Rate of Tropical Trees"*

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

P-1	Tom Abare and Benjamin Timm, Biology and Environmental Studies – *"The Effect of Buffering Shoreline Development in the Belgrade Lakes Watershed on Macroinvertebrate Communities"*
P-2	Mayra Arroyo and Jarildy L. Javier, Biology – *"Circadian Rhythms: Period Expression"*
P-3	Sergio Baez, Chemistry – *"Pollution and Erosion Prevention in the Belgrade Lakes Using Rain Gardens"*
P-4	Andrew L. Clevenger, Chemistry – *"Synthesis and Solubility of Oxacalix[2]napthalimide[2]naphthyridines"*
P-5	Kate Connolly, History – *"Clara Lemlich Shavelson: Jewish, Communist, Feminist, Activist, Labor Leader"*
P-6	Brian Doolittle, Pamela DuPre, and Gift Ntuli, Physics – *"Supercool K_{ids}"*
P-7	Marianne Ferguson and Savannah Judge, Biology and Environmental Studies – *"Using FlowCAM Technology to Assess Plankton Trends in Great Pond"*
P-8	Sara E. George, Geology – *"From the Depths of Great Pond: Anthropogenic and Natural Influences on Bottom Sediments and the Implications for Local Sustainability"*

P-9	Roxana Gheorghe, Computer Science – *"How Neurons Tick and Tock to Their Friends"*
P-10	Jingyan Guo, Economics – *"Over-Optimism in Private Output Forecasts: The Role of Over-Optimism in Commodity Prices and its Implications on Fiscal Policy"*
P-11	Sydney Hammond, History – *"Industrialized Rivers: A History of Russian Ingenuity and Its Consequences"*
P-12	Tionna C. Haynes, Sociology – *"Precious Cargo: The Gifts of Ethnic Diversity and Islam that Africans brought to the North American Continent"*
P-13	Erik Holmsen and Antoinette Newton-Acquah, Biology – *"Innate Immune Response of Phagocytic Cells in Zebrafish Exposed to Ethanol "*
P-14	Kyle Hughes, Biology – *"Direct Inhibition of Lye by Bacterioopsin"*
P-15	Alice Grubb Jones, Biology – *"Regulation of Wing Size and Patterning in True Bugs"*
P-16	Abebu Kassie, Chemistry – *"In Your Face: Effects of an Aromatic Shielding"*
P-17	Thabiso Kunene, Chemistry – *"Progress Towards the Synthesis and Characterization of a Copper (I)-phenyl Complex"*
P-18	Lauren Lacy, Sociology – *"Voices of the Vanguard: An Oral History of Black Women in the Twentieth Century"*
P-19	Sarah K. Lane-Reticker, Biology – *"The Quest for an Enzyme-Regulating Motif in Extremophilic Microbial Opsins"*
P-20	Olek Lato, Chemistry – *"Twisted Phenanthrenes"*
P-21	Abby Lebowitz and Jocelyn Thomas, Biology – *"Circadian Rhythms: Timeless Expression"*
P-22	Josephine Liang and Anna Kronauer, Psychology – *"Personality Change You Can Believe In: Concurrent and Prospective Relations between the Big Five Personality Traits and Subjective Well-Being"*
P-23	Jennifer Liao and Laura W. Morin, Biology – *"Characterization of Ethanol in Circadian Rhythm Defective Drosophila period Mutants"*

P-24 Laura W. Morin and Jennifer Liao, Biology – *"Characterization of Deficiency in Innate Locomotion in a Rotenone Induced Parkinson's Disease Model of Drosophila"*

P-25 Ellie Linden, Environmental Studies – *"Understanding What Information Visitors Learn Upon Visiting the Maine Lakes Resource Center and the Most Successful Marketing Techniques Used to Portray the Message of Conservation"*

P-26 Kathy Lipshultz, Science, Technology, and Society – *"The Belgrade Lakes: Their Impact on Local Culture and the Necessity of Their Preservation"*

P-27 Vania Lopez, Chemistry – *"Apoptotic Cleavage of Poly (ADP-ribose) Polymerase by Laromustine"*

P-28 Paul Macklis, Biology – *"The Effect of Acute Ethanol Exposure on the Innate Immune System"*

P-29 Sarah Madronal, Environmental Studies – *"Assessing LakeSmart Evaluations from 2009 to 2012 in the Belgrade Lakes Region of Central Maine"*

P-30 Omari Matthew, Biology – *"The Butterfly Effect: Analyzing Abundance and Diversity of Butterflies in Costa Rica"*

P-31 Gracey McGrory, Biology – *"Analyzing Bacterioopsin Inhibition of Lycopene Elongase Enzyme in Halobacterium volcanii"*

P-32 Megan S. Michie, Chemistry – *"Chemistry Out of This World: Generation of Propadienylidene"*

P-33 Astrid Moore, Psychology – *"Anything You Can Do, I Can Do Better: Comparing Choline Supplementation in Two Rat Strains"*

P-34 Andrew Newcomb, Environmental Studies – *"Variable Leaf Milfoil and Invasive Plant Management in Great Pond and Long Pond"*

P-35 Ryan Newell, Chemistry – *"Measuring Iron in the Ocean Using Preconcentration and Flow Injection Analysis with Chemiluminescence Detection"*

P-36 Gian Perani and Sophie Weaver, Biology and Environmental Studies – *"Effects of Buffering Shoreline Development on Shoreline and Sediment Composition in the Belgrade Lakes Watershed"*

P-37	Grovenia Perryman and Melissa Preziosi, Psychology – *"I'm Sure I Saw That Word or Did I? Producing Phonological False Memories of Words"*
P-38	Colin Sheehan, Chemistry – *"The Role of the BAG3 Gene on the Efficacy of Laromustine's Anticancer Effect"*
P-39	Jake Taylor, Chemistry – *"Effects of Laromustine on Human Leukemic Cells"*
P-40	Dan Totten and Ariel Oppong, Biology – *"Circadian Rhythms: Cryptochrome Expression"*
P-41	Tyler E. White, Chemistry – *"How Does a Blowtorch Relate to Sonogashira Coupling Chemistry?"*
P-42	Alexa Williams, Science, Technology, and Society – *"The Life and Scientific Achievements of Carl-Gustaf Rossby"*
P-43	Jinghui Yu, Computer Science – *"CPU Sim Redesign"*
P-44	Zhicheng Jacob Zhang, Chemistry – *"Iodination of Chemicals to Produce New and More Efficient Electrophiles"*
P-45	Zakary Jaques, Environmental Studies – *"Captive Conflict: The Consequences of Keeping Large Cats in Captivity"*

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**

"What do I stand for?"

Robert Hoopes (Colby class of 1989)
President of VOX Global

CUSRR

Session ID:

1-1

Abstract Title:

The Print and Contemporary Printmaking

Presenting Author(s):

Francesca Soriano ('16)

Other Authors:

Elizabeth Finch

Department:

Colby Museum of Art, Colby College, Waterville, ME

Abstract:

This summer I have worked as the curatorial intern at the Colby Museum, providing general support to the museum's curators as well as undertaking research on contemporary printmaking. My research has involved developing a list of artists who have made prints in the past five years and who would also be new additions to the museum's collection. From this list, the museum will seek to acquire one or more prints.

The process of researching has allowed me to learn both about a wide range of artists as well as about the printmaking process and the techniques involved in making different types of prints. A print is a work that has multiple editions and is made by a process of transferring ink onto paper. In the mid-twentieth century, certain artists working in the United States, most notably Stanley William Hayter, sought to establish print publishers similar to those in Europe. In 1940 Hayter founded Atelier 17, a print workshop where both emerging and established artists could work together. His interest in prints initiated a change in how people thought about the medium: rather than being simply a mode for creating reproductions of works of art, Hayter and others saw prints as a way to explore new modes of artistic expression. After Atelier 17 closed in 1955, numerous other print publishers opened, setting a standard for postwar American printmaking that involved close creative collaborations between artists and skilled master printers.

After compiling a long list of potential artists and prints, I worked with the supervising curator Beth Finch to edit the list, using a variety of criteria, to a dozen prints. If acquired the prints I will present will be used as teaching tools and in future exhibitions.

CUSRR

Session ID:

1-2

Abstract Title:

Development of a Next Generation Field-Portable Iron Sensor in Natural Waters Using a Natural Occurring Siderophore Desferrioxamine-B

Presenting Author(s):

Kimara F. Nzamubona ('14) and Juan Morotti ('15)

Other Authors:

Ryan C.Newell ('14), D. Whitney King, Zachary Helm ('09)*, Mark Wells*, Carl Tripp*, Madhira Gammana*, Valerie Smith*, and Kaiya Hansen*

Department:

Department of Chemistry, Colby College, Waterville, ME

Abstract:

Iron is an essential nutrient that drives bio-geochemical processes in marine ecosystems. Iron is known to limit phytoplankton growth in 40% of the world's oceans. Iron exists at an exceedingly low levels (< 2nM) in natural waters; henceforth, limiting the ocean's ability to sequester atmospheric carbon dioxide. Currently, there are no methods available to autonomously detect iron in natural waters because the current analytical systems require too much power and operator attention. This makes developing global maps of iron limitation in the ocean extremely expensive due to costs of ship time. The objective of this research is to develop next-generation field-portable iron sensors for natural waters based on the Fe (III) ligand desferroxamine-B (DFB).

This project is using DFB as a primary sensing molecule because it has strong binding affinity for iron, turns red, and it is commercially available. We have approached this project by chemically attaching DFB to Toyopearl resin beads through a reductive amination. DFB-Toyopearl is then packed into an analytical column that can complex and concentrate iron for analysis with Inductively Coupled Plasma (ICP). We will present the results on the design and performance of these new analytical materials for detection of iron in seawater.

Department of Chemistry, Colby College
*University of Maine, Orono

CUSRR

Session ID:

1-3

Abstract Title:

Sacrificing the Sacred: Land-Use Changes and Moral Shifts in Northern Ethiopian Church Forests

Presenting Author(s):

Ellen Evangelides ('14)

Other Authors:

Travis W. Reynolds

Department:

Environmental Studies Program, Colby College, Waterville, ME

Abstract:

Ethiopia has faced rapid deforestation in recent decades. Today, less than 5% of Ethiopia's original Afromontane forest cover remains, largely as a result of agricultural expansion, livestock grazing, and fuel wood demand. The remaining natural forest in Ethiopia's Northern Highlands is almost exclusively found in "church forests," which are small pockets of indigenous trees surrounding Ethiopian Orthodox Christian churches that have been preserved as sacred sanctuaries for centuries. These forest fragments serve as a home for a multitude of plant and animal species and provide insight into what Ethiopia's landscape once was. Today, even in areas of deep cultural and religious significance such as these church forests, the effects of economic pressures can be seen as native forests continue to steadily decrease in size. This research uses GIS-based spatial analyses of the past and present condition of church forests in the Amhara Regional State in northern Ethiopia, coupled with in-depth interviews with church priests and households, to study the roles of community resource governance within this unique cultural and ecological context. This research will ultimately yield a better understanding of how an array of local, national, and international bodies can effectively collaborate to support forest preservation.

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Session ID:

1-4

Abstract Title:

BDNF and the Sad Rat Solution: The Search for “Blue” Genes

Presenting Author(s):

Natasha K. Ziv (‘14) and Ariel A. Batallán (’15)

Other Authors:

Melissa J. Glenn

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

Brain-derived neurotropic factor, or BDNF, is a key growth factor protein responsible for physical neuronal and synaptic changes that occur during learning. The BDNF gene mediates the protein’s production in the brain, which exerts significant influence over functioning in regions such as the hippocampus and cortex. This growth factor is particularly vital for the sorts of morphological changes that occur and persist in the hippocampus following learning and enriching experiences. Not surprisingly then, diminished expression of BDNF is linked to a host of psychological disorders that have in common hippocampal dysfunction, learning and memory deficits, and emotional abnormalities, including depression, anxiety, schizophrenia, addiction, obsessive-compulsive disorder, and Alzheimer’s disease among others. An exciting new animal model that targets the role of BDNF in symptoms consistent with these disorders is presently under investigation in our lab: rats genetically engineered to have one copy of the BDNF gene were compared to wildtype rats with two copies of the gene on a battery of behavioral, physiological, neural, and epigenomic assays. In our presentation, we will describe the results of these experiments and attempt to assemble a comprehensive picture of the ways in which their overall functioning is or is not consistent with previous work on psychological disorders. Research on the mechanisms of action and behaviors affected in the model may lead to methods of neuroprotection against BDNF-related disorders.

CUSRR

Session ID:

1-5

Abstract Title:

Prejudicial Preferences: The Discriminatory Selection Practices of Colby's Greek Letter Societies

Presenting Author(s):

Katie Daigle

Other Authors:

Patricia Burdick

Department:

Miller Library Special Collections, Colby College, Waterville, ME

Abstract:

From their establishment in the 1840s until their abolishment in 1984, many Colby College fraternities and sororities boasted academic, philanthropic, and extracurricular excellence, as well as unity through "brother-" and "sister-hood." Yet, despite this projected image, certain fraternities and sororities implemented overt and subtle exclusionary practices, oftentimes selecting or denying student membership on a basis of race, religion, or ethnicity. Through prominent social influence, Colby's Greek letter societies consequently formulated an unspoken, yet palpable, understanding of what acceptable racial, religious, and ethnic "excellence" was to be, fracturing, rather than unifying, the student body.

Set against the United States' history of intolerance, the fraternal system's prejudicial practices reflect the extent of institutionalized discrimination. Analysis of the College's Colbiana archives – from personal correspondences to public and fraternal publications – will unearth the individually, locally, and nationally ordained membership clauses, recommendation systems, and membership patterns that maintained fraternities' biased and exclusionary customs. However, this research will also explore the alteration of fraternal policy in the 1960s, influenced by changing national sentiments regarding racial, religious, and ethnic acceptance, and by Colby's enforcement of anti-discrimination policies.

Overall, this study serves Colby's community by unearthing certain secret societies' history of bigotry. Yet, it also highlights the tenacity of key administrators and students who worked to break Colby's divided atmosphere. While I've been shocked by the blatant hate in some materials, I've been equally amazed by the efforts of others to address these moral injustices despite powerful organizations' resistance. I believe it is this same movement for campus equality that has contemporaneously carried onward. Looking into the past offers a basis for continual change in the future.

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Session ID:

1-6

Abstract Title:

To Fertilize or Not To Fertilize: Assessing Trophic Complexity in a Rainforest Ecosystem

Presenting Author(s):

Arianna A. B. Porter ('15)

Other Authors:

Cathy D. Collins

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Tropical deforestation is occurring at an alarming rate throughout our world today. It is critical that we actively try to restore these landscapes because rainforests provide our planet with important resources and services. However, it can be difficult to set appropriate goals for restoration. Under which conditions is a landscape the healthiest? For example, does addition of nutrients to the soil influence restoration success? One way to assess rainforest health is through ecosystem complexity, which can make a landscape more resilient to sudden changes in the environment. We can measure complexity by assessing the diversity and abundance of organisms at different trophic levels in an ecosystem. In order to understand the conditions under which rainforests are most successfully restored, we set up an experiment in an area where planted bamboo now out-competes native rainforest tree species. We cleared sixteen plots of bamboo and planted sixteen native trees per plot. To alter nutrient availability, fertilizer was added to half of the plots. We compared the developing complexity of the trophic levels in our plots according to the fertilizer treatment by quantifying the structure of our seedlings (amount of habitat for consumers), herbivory pressure (how much of the tree is affected by herbivores), and insect and spider (consumer) presence throughout the plot. These data provide an indication of species interactions occurring among trophic levels as our seedlings grow. We predict that plots treated with fertilizer will have increased herbivory pressure and also increased presence of insects and consumers due to more leaf tissue of higher quality and increased habitat (larger and more complex trees). Preliminary analyses suggest that only nine months after planting seedlings, taxa at multiple trophic levels are responding to our experimental treatments. Hopefully these findings can help guide future efforts in rainforest reforestation.

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Session ID:

1-7

Abstract Title:

The Prevalence of Depression and Dual Diagnosis in a Mental Health and Substance Abuse Treatment Center

Presenting Author(s):

Rhiannon Archer ('14)

Other Authors:

Matthew Archibald

Department:

Department of Sociology, Colby College, Waterville, ME

Abstract:

Depression has been referred to as the "common cold of psychiatry." Chances are most people have experienced the effects of depression in one way or another. Incidentally, a high level of substance abuse occurs on college campuses across the US. Some studies have shown that substance abuse leads to dependence and is often comorbid with various mental illnesses, especially depression. This presentation explores these two ideas: the high occurrence of depression diagnosis and the incidence of dual diagnosis, which is the diagnosis of a mental health disorder along with the diagnosis of a substance use disorder. Many research studies have focused on one or the other but this presentation will combine these ideas to determine why this phenomenon occurs. Reviewing previous research studies and meta-analyses, this presentation will provide a brief history of the prevalence of depressive disorder diagnoses as well as the prevalence of dual diagnosis. Drawing from inpatient records collected from a mental health and substance abuse treatment center in the eastern United States called Midland Central Hospital (to preserve confidentiality), this study will use various statistical techniques (e.g. SPSS) to examine the prevalence of dual diagnosis and depression diagnosis in a facility that treats both. Is there an unspoken reason among mental health professionals for the prevalence of depression and dual diagnosis? Do these diagnoses differ among different census populations (e.g. age, gender)? What kinds of resources do these patients receive in comparison to other mental health patients? Preliminary analyses of the data from Midland investigate these questions.

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Session ID:

1-8

Abstract Title:

Cats in Akif Pirinçci's 1989 Novel, *Felidae*

Presenting Author(s):

William Qualey ('16)

Other Authors:

Arne Koch

Department:

Department of German and Russian, Colby College, Waterville, Maine

Abstract:

This short presentation is part of a larger project examining the role of cats in German literature and culture. It starts with an overview of the important role of the animal "other," which is sometimes made problematic by the fact that an anthropomorphized animal protagonist can be read as either a mere exemplar of human characteristics or as an entirely inhuman perspective. It then attempts to show how Akif Pirinçci, author of the 1989 German bestseller *Felidae*, skillfully uses a cat's perspective not only to upend the traditionally assumed human dominance in animal-human relations, but also to provoke discussion about such sensitive topics in German culture as the Second World War and immigration.

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Session ID:

1-9

Abstract Title:

Purification and Characterization of pRMG, a Novel Peptide that Binds Damaged DNA

Presenting Author(s): Connor P. McGuckin ('15)

Other Authors: Rachel Guerra and Kevin P. Rice

Department: Department of Chemistry, Colby College, Waterville, ME

Abstract:

We previously identified a novel fifty amino acid peptide that is designed to bind to a particular form of damaged DNA. This peptide, pRMG1, was selected from a pool of over a billion similar sequences using a form of *in vitro* evolution known as phage display. The protein, pRMG1, was engineered to bind DNA that contains a break, referred to as a DNA "nick" in the chain on one of the strands in the DNA double-helix. DNA nicks occur in many natural cell processes and are usually readily repaired. However, DNA in cells undergoing rapid division, such as cancer cells, or in cells exposed to DNA-damaging environments, is more likely to contain nicks. The synthetic gene that encodes pRMG1 was used to identify the amino acid sequence of the peptide. In order to study the peptide, the gene was cloned into *E. coli* bacteria in order to produce and then purify it from culture. The peptide was also modified at the genetic level to contain a "FLAG-tag", which is an eight amino acid peptide chain that assists in the extraction of the protein from the rest of the soluble proteins. Given pRMG1's small size, peptide samples are being analyzed by mass spectroscopy. Following its successful purification, pRMG1's ability to bind to nicked DNA will be tested using a biophysical technique called "fluorescence polarization." The successful demonstration of strong binding to nicked DNA by such a small peptide would be important proof-of-principle exercise with many possible applications. It could potentially lead to diagnostic tools for monitoring DNA damage or therapies for sensitizing cells to DNA-damaging anticancer agents.

CUSRR

Session ID:

1-10

Abstract Title:

The History of Fear in the Ancient Mediterranean

Presenting Author(s):

Indiana W. Jones ('14)

Other Authors:

Larissa J. Taylor

Department:

Department of History, Colby College, Waterville, ME

Abstract:

This investigation targets the history of fear in the Classical period with the objective of grasping the roots of a variety of fears and superstitions in the origins of the Western world. I pursue this goal by examining trends such as homophobia and anti-Semitism in a variety of ancient sources, from the elaborate funerary pageants of the Romans to the philosophical musings of Plato. This endeavor is a true passion project as it not only carries forward the momentum of a rich semester course of debate and discussion on this topic, but also tackles the discipline of history in a novel and accessible way: through the lens of a specific, universal emotion. Drawing out the ancient history of humanity's fears can reveal to us the essence of the social stigmas and widespread phobias, which, in many cases, still haunt our society today.

CUSRR

Session ID:

2-1

Abstract Title:

CPU Sim Redesign

Presenting Author(s):

Ben Borchard ('14) and Stephen Morse ('14)

Other Authors:

Jinghui Yu ('15) and Dale Skrien

Department:

Department of Computer Science, Colby College, Waterville, ME

Abstract:

Computers are very widely used, but not as widely understood on the machine level. To assist students in learning the low level structures that exist within a CPU (Central Processing Unit--the "brains" of a computer), professor Dale Skrien created a program named CPUSim. This software allows users to develop and simulate their own CPU systems, writing and running low level machine and assembly language programs to complete simple tasks. Our project, this summer, has been to remake and improve the user interface for CPUSim using a software package known as JavaFX. This project has required us to think creatively, regularly determine what features the user would find most useful, and come up with new solutions to problems that arise from changing CPUSim to run using JavaFX. CPUSim is currently being used in a variety of different institutions around the world to help many people learn about computer architecture, and is even being translated to Chinese. In a world where Computer Science and technology are so prevalent, CPUSim stands out as a tool to help students learn the fundamentals of CPU processing. The many improvements and entirely new interface that result from this project will greatly improve the software.

CUSRR

Session ID:

2-2

Abstract Title:

Life in the Belgrade Lakes Watershed

Presenting Author(s):

Xiaojie Chen ('16) and Lucy O'Keeffe ('14)

Other Authors:

Michael R. Donihue

Department:

Department of Economics, Colby College, Waterville, ME

Abstract:

Environmental amenities such as lakes are often important drivers of local and regional economic activity (Kasul et al., 2010; Bergstrom et al., 1990). An economic impact analysis is a common method used by economists and policymakers to estimate the direct and ripple effects of expenditures in an area. In our analysis of the Belgrade Lakes Region, we use data collected from an economic survey that was distributed to year-round and seasonal residents of the Watershed. This survey was designed to explore the social and economic dimensions of the area as well as to capture information on spending, income, and general knowledge about the state of the lakes. Using the IMPLAN model, a widely used econometric software program originally developed by the U.S. Forest Service, we determine the overall economic impact generated by the lakes and the multiplicative effect that spending has on the local economy. It is important to note that an economic impact assessment is only one measure of value, and many critical attributes of environmental resources cannot be easily monetized into this type of modeling. By the end of the summer, the results of our research will hopefully help to better understand the economic value of the different groups that interact with and depend on the Watershed. This may help to better inform decisions by policymakers that affect ecosystem services and conservation land-use practices in lake watershed environments.

Bergstrom, J. C., H. K. Cordell, et al. (1990). "Economic impacts of state parks on state economies in the South." Southern Journal of Agricultural Economics **22**(02).

Kasul, R., D. Stynes, et al. (2010). Characterization of Park Visitors, Visitation Levels, and Associated Economic Impacts of Recreation at Bull Shoals, Norfork, and Table Rock Lakes, DTIC Document.

CUSRR

Session ID:

2-3

Abstract Title:

Towards the Synthesis of an Unreported Copper(I)-Naphthyl Complex

Presenting Author(s):

Max D. Cushner ('14)

Other Authors:

Thabiso Kunene ('15), Thora Maltais ('09), Kathryn Sherry ('10), Daniel Goldstein ('11), and Rebecca R. Conry

Department:

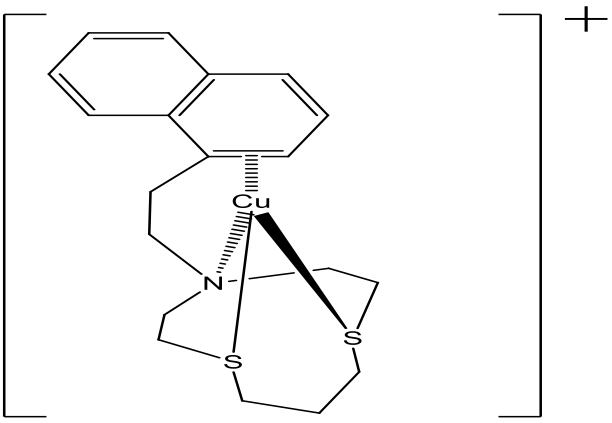
Department of Chemistry, Colby College, Waterville, ME

Abstract:

We are studying a rare type of reactive species, copper(I)-arene complexes. Metal-arene complexes, which contain one or more neutral aromatic rings such as benzene or naphthalene bound to a metal ion, are known for most transition metals. However, there are very few copper-arene complexes. In those complexes arene ligands bind weakly to the copper(I) ion, making them moderately reactive. For example, copper(I)-arene complexes can be used as a catalyst for the aziridination of olefins, to add a nitrogen-containing group across a carbon-carbon double bond to form a three-membered ring.

We are synthesizing copper(I)-naphthyl complexes, in which the naphthyl group is tethered to a macrocyclic ligand containing sulfur and nitrogen binding atoms. The first such naphthyl complex we made has interesting and unique properties compared to previously reported copper-arene complexes. For instance, the naphthyl group binds to the copper(I) ion in solution, not just in the solid state. Such copper(I)-arene binding in solution allows us to characterize and study the complex with methods that cannot be used for complexes that only bind the arene in the solid state.

My progress towards the synthesis and characterization of an unreported copper(I)-naphthyl complex shown below will be described. This synthesis requires five steps to assemble the ligand and another two to make the complex.



CUSRR

Session ID:

2-4

Abstract Title:

The Best Years of Your Life? An Examination of Social Belonging in the Colby Community

Presenting Author(s):

Kelsey M. Park ('14) and Anna N. Rabasco ('13)

Other Authors:

Erin S. Sheets

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

Social belonging, an individual's sense of fit and connectedness to their community, has been associated with greater well-being, less depression, and better academic performance in college. The current research project took a mixed methods approach to identify factors that positively and negatively impact sense of belonging at Colby College. Fifty-five students answered questionnaires assessing sense of belonging and participated in small focus groups. Qualitative data revealed major themes of drinking culture, academics, and minority/majority status affecting social belonging, but interestingly these factors could have either positive or negative effects depending on the student's background and perspective. Students also discussed a weekend and weekday dichotomy at Colby in which students are more likely to speak and act in ways on the weekends that go against the values they promote during the week. A final theme that emerged was that students commonly believed that social belonging requires work, such as joining a team or club, participating in the dominant social life, and/or being extroverted. Quantitative analyses reinforced the importance of social belonging: feeling part of the larger college community was associated with lower anxiety and psychological well-being. These findings could help in designing a future intervention to promote social belonging at Colby College and other similar settings.

CUSRR

Session ID:

2-5

Abstract Title:

Taking a Stab at Murder Mystery

Presenting Author(s):

Sarah Leathe ('15) and Kyle Laurita-Bonometti ('15)

Other Authors:

Jennifer Boylan

Department:

Department of Creative Writing, Colby College, Waterville, ME

Abstract:

My general projects this summer are to write creatively and to assist Professor Boylan in her research for her book. My more specific goal for this summer is to write a series of short stories from the point of view of different people that, collectively, tell a larger story of the path and investigation into a serial killer. My project is important and exciting to me because this is the first time that I've been given a set period of time just to write, which means I will be able to create a much larger body of work (hopefully 50+ pages) than I can during the school year (usually 10-15 pages). This should be exciting for you, because if all goes well, I will end up with part or all of a collection of short stories for you to read, if you like murder mysteries. I began writing by creating a list of all people and places I wanted to include, and a general plot outline. From there, I began writing individual stories. I will write them without a lot of thought as to which order they occur in, and I will arrange them when I feel that I have finished. Thus far, I have finished the planning stages of my writing, and have begun creating the stories themselves. My efforts contribute to the work produced by Colby authors and the research done by Professor Boylan.

CUSRR

Session ID:

2-6

Abstract Title:

Hey! Is that Choline in Your Pocket or Are You Just Happy to See Me? Exploring the Interactions of Dietary Choline and the Antidepressant Imipramine

Presenting Author(s):

Czarina Evangelista ('14) and Alexandra L. Brown ('14)

Other Authors:

Melissa J. Glenn

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

Choline is an essential nutrient found in a variety of foods including broccoli, meat, and eggs. Prenatal choline supplementation has numerous protective effects on the adult brain, such as enhancing cognition and attenuating the impact of neural insults. These benefits may be mediated by life-long enhancements in neural plasticity, specifically hippocampal neurogenesis, and problems with this process are integral in the pathological features of psychological disorders such as depression. Our lab recently demonstrated that developmental choline supplementation is antidepressant in adult female rats. In the present study, we continued this work by investigating the interaction between choline and acute and chronic administration of the antidepressant imipramine. To do this, pregnant rats were fed diets containing standard (STD) or supplemental (SUP) choline and female offspring were reared to adulthood for testing. Acute imipramine was assessed using a test of despair and chronic imipramine was assessed using tests of anxiety and memory. We also examined hippocampal neurogenesis following chronic imipramine. Several doses of imipramine were used to test the hypothesis that lower doses would be needed for antidepressant properties to emerge in the SUP rats. The findings so far revealed that imipramine, given acutely, attenuated despair in rats and this effect was greater in SUP rats at the largest dose. However, we did not find evidence to support the hypothesis that imipramine at low doses was more effective in SUP rats at attenuating despair. Presently, the effects of chronic imipramine treatment are under investigation and will be combined with the acute findings to further our understanding of the ways that choline is neuroprotective against depression.

CUSRR

Session ID:

2-7

Abstract Title:

Women's Struggles as Poets in 19th-century France

Presenting Author(s): Pamela A. Alakai ('14)

Other Authors: Adrianna Paliyenko

Department: Department of French and Italian Studies, Colby College, Waterville, ME

Abstract:

As a French and Global Studies major focusing on women's rights, I want to understand why women have yet to gain full recognition for their work. To what extent has women's situation improved since their transnational emancipatory movements in the 19th century? My summer research explores this question by focusing on the struggles that European women faced in post-Revolutionary France in seeking equal access to the literary and scientific world.

Women's poetic innovations are absent from traditional literary history. In her manuscript *Genius Envy: Women Shaping French Poetic History,* Prof. Paliyenko shows that, throughout the 19th century, women published original poetry, and thus paved the way for the following generation, overcoming hostile critics, stigma and marginalization.

Part of my work involves quantifying women's history as poets. The difficulty of the task lies in that their poetic contributions are not centrally located. Rather, one finds them in newspapers, journals, and other annals of the period, such as gift books and special anthologies. To prepare a comprehensive list, which will confirm Paliyenko's findings, I am using the *Bibliographie de la France*. Now digitized, this bibliography records all books published in France since 1814. Changes in the way that women signed their work along with changes in the bibliography's format make this research all the more challenging.

I am also assisting Prof. Paliyenko in the development of an online archive that presents salient chapters of 19th-century French women's history as poets. Additionally, I am conducting extensive research on the evolution of key words in Prof. Paliyenko's study, such as genius and creativity. Through this work, I have gained a new appreciation for the power of words, how crucial it is that we choose and use words wisely, along with a fuller understanding of why women's history repeats itself.

CUSRR

Session ID:

2-8

Abstract Title:

Nutrient Limitation in the Belgrade Lakes Watershed

Presenting Author(s):

Theresa Petzoldt ('14) and Becky Forgrave ('14)

Other Authors:

Denise Bruesewitz

Department:

Department of Environmental Studies, Colby College, Waterville, ME

Abstract:

Nutrients, including nitrogen (N) and phosphorus (P) are critical for sustaining aquatic food webs. However, inputs of excess nutrients due to anthropogenic activity can cause many negative consequences including harmful algal blooms, periods of hypoxia, and loss of aquatic biodiversity. Our goal is to understand patterns of nutrient limitation in the Belgrades catchment, encompassing six lakes and their tributary streams on a landscape scale. We hypothesize that the lakes will be primarily P-limited, while the streams connecting them will be N-limited and periods of co-limitation between N and P may be common. However, these patterns could shift seasonally based on trophic state of the lake, location in the watershed catchment, or land use patterns for each sub-catchment. We use a suite of bioassays to determine nutrient limitation in the catchment. We use nutrient diffusing substrata (NDS) to measure nutrient limitation of stream biofilms and an analogous bioassay for examining patterns of nutrient limitation for lake phytoplankton throughout the Belgrades catchment. Geographic distribution of nutrients in the watershed is also investigated by taking samples at regular intervals the length of the stream. These data are supplemented by sediment core experiments to measure the contribution of lake sediments to nutrient dynamics.

This research adds to previous research on the Belgrade Lakes watershed that explores the relationship between human and environmental systems. Because our study takes a landscape approach, it can inform a wider range of policy decisions for the area, and especially may show the importance of mitigating N loads to our aquatic ecosystems. This landscape scale also distinguishes us in the field of stream ecosystem ecology because we will be comparing ecosystem function metrics on a broad spatial scale.

This study combines multiple scientific disciplines to create a study that is both relevant and interesting to the local community. Because local people care about the Belgrade Lake system, they are interested in helping us with our study and learning about the results, which is a very exciting aspect of our study. It is also interesting to note that this is a study in interfaces: the interface of humans and science, that of land and water, and the interplay of streams and lakes. The strong human element in this study means that it can play an important role in creating environmental consciousness and affect positive change. As citizens of this community (even temporary ones), we should all work understand these dynamics and be a part of a positive change.

CUSRR

Session ID:

2-9

Abstract Title:

Paradoxes in Pentecostalism: How Practitioners' Perceptions are Discontinuous with Reality

Presenting Author(s): Sam LeBlanc ('15)

Other Authors: Sonja Thomas

Department: Department of Women's, Gender, and Sexuality Studies, Colby College, Waterville, ME

Abstract:

My summer research project is an examination of gender, class, global Pentecostalism and Indian Charismatic Christianity. According to oral tradition among Indian Christians, St. Thomas introduced Christianity to India in 52 A.D.. Until the 1990's, the religion largely remained faithful to Eastern rites and traditionally did not allow women to participate in the decision making processes of the Church. Starting in the 90's and continuing today however, Pentecostalism and Charismatic Christianity have drastically changed the face of Indian Christianity. The participation of women and people of varying castes and religions marks that major shift.

For my research project, I am trying to gather as much information as I can on how women participate in, understand, and are treated in Pentecostal communities and how class affects those experiences. I am also transcribing interviews that Sonja Thomas, Professor of Women's Gender and Sexuality Studies, conducted with Indian Pentecostal women and utilizing that information in my conclusions.

Though Professor Thomas is focusing specifically on women and caste in a Pentecostal community of India for her research, I am researching the patterns of the religion on an international scale. In this talk, I will discuss the literature on global Pentecostalism, the process of making my own annotated bibliography, and the similarities I am seeing between the information I have found by transcribing interviews and my collected annotated bibliography. By the end of the summer, I hope to provide Professor Thomas with an articulate summary of the trends and norms of global Pentecostalism with a particular focus on women's participation and class inequalities.

CUSRR

Session ID:

2-10

Abstract Title:

The Effect of Fertilizer and Species Evenness on the Relative Growth Rate of Tropical Trees

Presenting Author(s):

Julia Rogers ('16)

Other Authors:

Cathy D. Collins

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Rainforest restoration is an important topic in ecological research because rainforests continue to be cleared for agriculture, fuel, and urban development. Our study takes place At Firestone Center for Ecological Restoration in Dominical, Costa Rica, where land that was once deforested for cattle grazing and then planted with non-native bamboo is now used for research, Our goals are to determine whether there is an effect of species' abundance and available nutrients on the growth rates of trees seedlings. In each of 16 plots, 16 native rainforest trees were planted in 2012. Each plot contains 7 species total; however, the number of individuals within a species in each plot varies. Half of the plots contain similar numbers of each species, while the other plots have one abundant species, and many rare species. This allows us to study the effect of relative species abundance on the rate of growth of the trees. Additionally, some of the species are "early bloomers", meaning that they will grow faster in full light before canopy cover develops, while other species are "late bloomers" because they grow better in the shade,

Another aspect is the addition of nutrients. Half of the plots received extra nutrients twice altering the level of competition within the communities, and also allowing us the ability to look at the effect of the nutrients on different tree species. To achieve the research goals, we estimated the height and biomass of 256 trees, 64 in each experimental treatment.

Our rainforest restoration research is important because most rainforests are in highly protected areas. The fact that our study occurs on private property means that we can manipulate factors potentially important to successful restoration. This project can help to further rainforest restoration by determining better methods to promote the healthiest restoration.

CUSRR

Session ID:

P-1

Abstract Title:

The Effect of Buffering Shoreline Development in the Belgrade Lakes Watershed on Macroinvertebrate Communities

Presenting Author(s):

Tom Abare ('15) and Benjamin Timm ('14)

Other Authors:

Catherine Bevier and F. Russell Cole

Department:

Department of Biology and Environmental Studies Program, Colby College, Waterville, ME

Abstract:

The influence of shoreline development on lakes can be mitigated using lake-friendly landscaping and best management practices on properties. These practices help protect lake health by reducing nutrient and sediment loading, and potentially protecting biodiversity. An effective buffer strip, for example, is wide with many layers of vegetation that decrease erosion potential and allow water to be absorbed by the soil. The LakeSmart and "Are You Buff Enough" programs in Great, East and North Ponds of the Belgrade Lakes were created encourage these practices. Properties are assessed and certified if they meet lake-friendly criteria. To evaluate the success of programs like these, we surveyed the density and diversity of aquatic macroinvertebrates at developed sites with and without lake-friendly landscaping and at adjacent undeveloped sites, used as reference sites. The presence, or lack thereof, of pollution intolerant and pollution tolerant species is used as an effective biological indicator of the level of disturbance in an area, and serves as a proxy for a lake's overall health. In the summer of 2012, substrate, rocks and woody structure were sampled along 10M transects at 0.5M and 1.0M depth, and all invertebrates were collected, preserved, and identified. Final results from statistical and metric analyses are forthcoming, which will help gauge the effectiveness of LakeSmart certifications for the conservation of invertebrates. By comparing richness and abundance measures of these species at buffered and unbuffered developed sites to a determined reference condition, we hope to discover how overall lake health in the Belgrade Lakes is being affected by shoreline development.

CUSRR

Session ID:

P-2

Abstract Title:

Circadian Rhythms: Period Expression

Presenting Author(s):

Mayra Arroyo ('16) and Jarildy L. Javier ('16)

Other Authors:

Devin Gibbs ('14), Dan Totten ('14), Abby Lebowitz ('15), Ariel Oppong ('16), Jocelyn Thomas ('16), and Andrea Tilden

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Circadian rhythms are endogenously driven cycles that operate on an approximately 24-hour clock and entrain organisms to their environments. For example, sleep-wake cycles can typically be prompted by light-dark stimuli. At the cellular level, molecular processes of protein transcription, translation, and negative feedback drive circadian rhythms. Many circadian rhythm proteins are phylogenetically conserved in organisms as diverse as bacteria and humans. Essentially nothing is known about the molecular mechanisms of circadian rhythms in crustaceans. With the very recent publication of the first complete crustacean genome in 2010 (the water flea *Daphnia pulex*), we now have access to the bioinformatic tools to explore these mechanisms.

The purpose of our research is to determine the location and patterns of expression of circadian rhythm proteins in a variety of crustaceans with diverse ecological profiles, for example freshwater versus marine, and aquatic versus intertidal. In this study we specifically focused on a protein called period. Changes and oscillations in levels of both period transcript and its corresponding protein period have a cycle of approximately 24 hours and together play a central role in the molecular mechanism of the *Drosophila* biological clock driving circadian rhythms in eclosion and locomotor activity.

We are using immunohistochemistry with fluorescent labeling to localize period expression to specific tissues, structures, and times of day. We are using whole-mount *Daphnia* and dissected neural tissues from *Uca pigulatora (Fiddler Crab)* for cell culture and whole-tissue staining.

CUSRR

Session ID:

P-3

Abstract Title:

Pollution and Erosion Prevention in the Belgrade Lakes Using Rain Gardens

Presenting Author(s): Sergio Baez ('16)

Other Authors: Jade Enright ('15), D. Whitney King, and Charlie Baeder

Department: Department of Chemistry, Colby College, Waterville, ME

Abstract:

Phosphorus is the primary limiting reagent in most lake ecosystems and excess phosphorus can result in declining water quality through algal blooms, oxygen depletion, and fish kills. Shoreland best management practices detail procedures and engineered structures that reduce phosphorus input from runoff into the lake. A rain garden is shallow garden impoundment that captures rainwater from the roof and driveways of homes and infiltrates the water through a soil layer keeping up to 90% of pollutants from entering the lake. A rain garden consists of multiple types of soils and native plants that both filter and absorb excess pollutants. By installing rain gardens in their backyards, homeowners can ensure the continuity of their healthy lake, as well as preserve beauty and value of their property. This work evaluates the effectiveness of rain gardens at retaining and infiltrating rainwater in the context of Maine soils and climate.

In order to simulate rain events, water was pumped into a rain garden using a 150-gallons per minute pump until the rain garden was full and overflowing. One differential pressure transducer was placed in the deepest part of the rain garden and the other was placed at atmospheric pressure in order to calculate log hydraulic head in rain gardens after the pump treatments. Depth measurements were taken of different sections of the rain garden in order to calculate the volume of water the rain garden could hold while it was full. The data collected from the MLRC and Day's Store show that a rain garden can retain 626 cubic meters of water can treat the water at a flow of .0026 meters per second. Further analysis may yield the ratio of water retained to the flow of treated water, which would assist homeowners in deciding the shape and depth of their new rain gardens.

CUSRR

Session ID:

P-4

Abstract Title:

Synthesis and Solubility of Oxacalix[2]napthalimide[2]naphthyridines

Presenting Author(s): *Other Authors:*

Andrew L. Clevenger ('15)	Jeffrey L. Katz

Department:

Department of Chemistry, Colby College, Waterville, ME

Abstract:

Oxacalixarene chemistry has been the focus of study in the Katz Group for years. Part of the work has been to create wider and longer molecules for molecular recognition purposes. Oxacalixarenes are synthesized using nucleophilic aromatic substitution reactions, usually using a dihalogenated benzene ring as the electrophile and a diphenol as the nucleophile. Research has been done to double the length of each side of the molecule, using a 2,7-dichloro-1,8-naphthyridine as the electrophile and a naphthalimide as the nucleophile. The problem with this class of oxacalixarenes is their poor solubility in common organic solvents. The main goal of this project is to add different groups to the N positions on the naphthalimide to increase the solubility of the resulting oxacalixarene. The reaction schemes are shown in Figures 1 and 2. These oxacalixarenes were analyzed using NMR spectroscopy and single crystal X-ray diffraction.

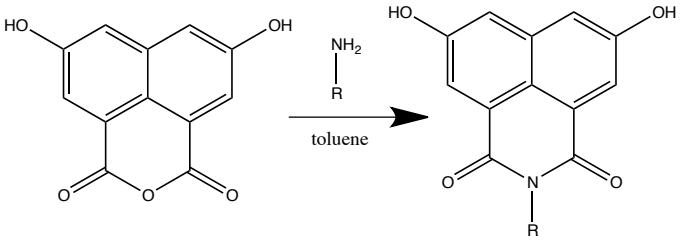
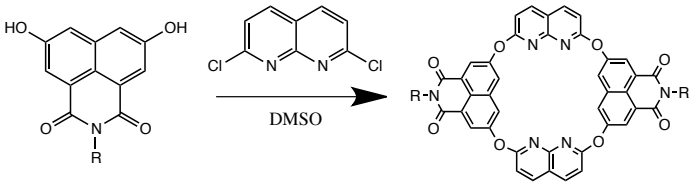


Figure 1: Reaction of naphthalic anhydride with an amide to give a naphthalimide



CUSRR

Session ID:

P-5

Abstract Title:

Clara Lemlich Shavelson: Jewish, Communist, Feminist, Activist, Labor Leader

Presenting Author(s):	*Other Authors:*
Kate Connolly ('14)	Rob Weisbrot

Department:

Department of History, Colby College, Waterville, ME

Abstract:

This project will research Clara Lemlich Shavelson, a 20th century reformer and communist. Her life illustrates the interactions "between personal and political, between feminism, trade unionism, and 20th century government politics" (Orleck, 11). This research will address the role of women, Jews, and Judaism in the Communist Party, and government attitudes toward communism and immigrants.

The research will attempt to answer the following questions: why did Shavelson, a successful reformer as a strike leader, an advocate of woman's suffrage, and a community activist, become a communist? What can her life tell us about the history of labor protests, industrial feminism, and American communism? The texts for research are a biography of four Jewish female labor leaders: *Common Sense and a Little Fire* written by Annelise Orleck, several communist publications, such as the *Daily Worker,* mainstream newspapers such as the *New York Times*, and primary sources from communist front organizations' archives. Thus far, I have completed preliminary research on Shavelson's life, and begun to research a Communist-front civil liberties group in which Shavelson was active, the American Committee for the Protection of the Foreign Born, and the role of women in the Communist Party from 1919-1940s.

Professor Weisbrot's biography on Clara Lemlich Shavelson will add to the growing literature on American working-class women, a relatively new field of study. The history of American labor movements focuses on male labor leaders and male union organizers, marginalizing the role of women and minorities in such movements. Adding the perspective of women and minorities to the existing historical narrative reshapes our understanding of 20th century social activism and provides background and context for later civil rights movements. Accounts from women and minorities from the early 1900s, now incorporated in historical narratives, are a key to revising 20th century United States social and political history.

Orleck, Annelise. *Common Sense and a Little Fire: Women and Working-Class Politics in the United States, 1900-1965*. Chapel Hill: The University of North Carolina Press, 1995.

CUSRR

Session ID:

P-6

Abstract Title:

Supercool K_{ids}

Presenting Author(s):

Brian Doolittle ('14), Pamela DuPre ('16), and Gift Ntuli ('14)

Other Authors:

Charles Conover

Department:

Department of Physics, Colby College, Waterville, ME

Abstract:

The goal of our project is to excite potassium atoms into a simplified state, called a Rydberg state. Potassium atoms are trapped in an evacuated chamber using magnetic fields and a trapping laser. This apparatus, called a Magneto Optical Trap (MOT), successfully slows atoms down from velocities of thousands of m/s to tens of m/s. The Rydberg states will be induced by a 405 nm (blue) laser and a 980 nm (red) laser. A computer is required to control the lasers on the order of milliseconds with a sequence of electrical pulses. Experiments with Rydberg states allow us to study energy transfers in many-body systems. This is useful because it helps us to understand and apply quantum mechanics to real world scenarios and technology.

Using the MOT, we successfully trapped a 1 mm wide cloud of SUPERCOOL potassium atoms. To optimize the cloud, we measured the density of the potassium cloud as a function of the trapping laser color, magnetic field strength, and number of potassium atoms being pumped into the evacuated chamber. The density of the potassium cloud was optimized using a trap laser frequency of 235 MHz and 8 amps of current flowing through the magnetic coils. As more potassium was pumped into the vacuum chamber, the density of the cloud increased. We have stabilized the blue laser to the correct color required to excite the first transition into the Rydberg state. Next, the red laser needs to be tuned and stabilized to drive the final Rydberg transition. We can successfully send a sequence of electrical pulses on the order of microseconds from a programmable microprocessor called an Arduino. Later, these pulses will be used to control the MOT, the red laser, and the blue laser. Data is acquired and transferred to a computer using a National Instruments multifunction data acquisition chip.

CUSRR

Session ID:

P-7

Abstract Title:

Using FlowCAM Technology to Assess Plankton Trends in Great Pond

Presenting Author(s):

Marianne Ferguson ('14) and Savannah Judge ('15)

Other Authors:

Sarah Large ('14), Catherine Bevier, and F. Russell Cole

Department:

Department of Biology and Environmental Studies Program, Colby College, Waterville, ME

Abstract:

Lakeshores are increasingly being transformed from their natural forested and wetland cover to open, developed lawns, sandy beaches, and impervious surfaces associated with residential development. These changes can affect lake water quality and ecosystem function, largely through nutrient loading. Real-time monitoring using sensory arrays for biogeochemical variables such as water pH, temperature, and dissolved oxygen provides a data stream that may allow scientists to develop a more complete picture of a water body and heighten understanding of processes like stratification and lake mixing. Colby College recently deployed a high-frequency monitoring buoy, affectionately known as Goldie, in Great Pond. Photosynthetic organisms like phytoplankton need light to survive and reproduce, and fluorescence measurements can be a proxy for phytoplankton biomass. Similarly, PAR (photosynthetically active radiation) levels may be used to understand variation in phytoplankton abundance. To test the reliability of this sensor data as measures of phytoplankton biomass, we are making weekly collections of water at various depths below the surface of Great Pond at the buoy and four other sampling sites. We assess the concentration and diversity of the phytoplankton using the FlowCAM, which records images and catalogs particle counts in the water samples. Results of these weekly surveys will be compared to relevant sensor data to calibrate the relationship between fluorescence and actual phytoplankton concentration. This will help determine how well the spatial and temporal patterns of harmful algal blooms may be predicted from real time sensor data. Going forward, we will classify the species in each sample, determine their ecological significance and track population trends.

CUSRR

Session ID:

P-8

Abstract Title:

From the Depths of Great Pond: Anthropogenic and Natural Influences on Bottom Sediments and the Implications for Local Sustainability

Presenting Author(s):

Sara E. George ('15)

Other Authors:

Clara G. Bicher ('14) and Bruce F. Rueger

Department:

Department of Geology, Colby College, Waterville, ME

Abstract:

As part of a Maine EPSCoR grant focusing on sustainability in the Belgrade Lakes watershed of central Maine, current research consists of collecting bottom sediment samples from Great Pond. Great Pond has the largest surface area (3,453 ha) of the seven lakes in the watershed. Most of its water comes from East and North Ponds via Great Meadow Stream, as well as the surrounding uplands and groundwater discharge. Lake volume and area was increased by the construction of a hydroelectric dam in 1886. To evaluate natural and anthropogenic changes in the lake environment, 67 samples were collected using an Ekman dredge and were analyzed to create a sediment map of the lake basin in regards to depth, grain-size distribution, organic content (%C), C:N ratios and phosphorus concentration. Results will aid in the understanding of the glacial formation of the lake, distribution of sediment within, and human impact on the lake. Additionally, knowing the distribution of phosphorus within the sediments may allow development of a strategy to avoid accelerated eutrophication. These results will be compared with previous research on nearby East Pond sediments. This research will add to the geologic knowledge base of lake sedimentation and chemistry and will provide data that can be used by local conservation groups for community education and advocacy for best sustainability practices in the Belgrade Lakes watershed.

CUSRR

Session ID:

P-9

Abstract Title:

How Neurons Tick and Tock to Their Friends

Presenting Author(s):

Roxana Gheorghe ('15)

Other Authors:

Stephanie Taylor

Department:

Department of Computer Science, Colby College, Waterville, ME

Abstract:

Most biological processes in living organisms show circadian rhythms, meaning that they repeat every 24 hours. For mammals, the master clock driving the circadian rhythms is located in the brain in an area called the suprachiasmatic nucleus (SCN). The SCN is made up of thousands of neurons that send non-ambiguous information about the time of day to the rest of the body. The neurons act like coupled oscillators, so the behavior of each neuron influences the behavior of the others. To understand how the neurons in the SCN interact with each other to synchronize and regulate circadian rhythms, it is imperative to know how the cells are connected.

The goal of this project is to determine the structure of the network connecting neurons in the SCN. We cannot measure the connections directly, but we can measure the phase (time of day) of each cell. I am testing the assumption that cells with the most similar phases are connected to each other.
Using mathematical models, I am generating networks with various initial conditions and arrangements, simulating circadian rhythms, and computing the phases of the cells during the simulation. Then I construct new networks based on phase-similarity and test the prediction. Preliminary results show that phase-similarity by itself is not enough to accurately predict the connections of the neurons of the SCN. A combination of other network manipulations, such as the intrinsic properties of the cells or the density of the network connections, is needed to produce an accurate guess of the actual network.

Revealing how the neurons of the SCN are connected and how they interact with each other will have important implications for prevention and treatment of circadian rhythm disruptions, including mood and sleep disorders.

CUSRR

Session ID:

P-10

Abstract Title:

Over-Optimism in Private Output Forecasts: The Role of Over-Optimism in Commodity Prices and its Implications on Fiscal Policy

Presenting Author(s):

Jingyan Guo ('15)

Other Authors:

Guillermo Vuletin

Department:

Department of Economics, Colby College, Waterville, ME

Abstract:

This project contributes to the literature that analyzes the over-optimism in private output forecasts, particularly the role of over-optimism in commodity prices and its implications on fiscal policy. The real GDP growth rate forecast error is one of the biases in macroeconomic forecasts, and the forecast errors are typically biased towards over-optimism, particularly during booms. Our paper has two objectives: i) we want to analyze whether there exists a bias in forecasts of economic activity by private institution and ii) we aim to study what policy implications emerge from those forecast errors, and what effect they have on procyclical fiscal policies. We can draw public policy lessons regarding the ability of governments to use macroeconomic forecast for policy decisions. It can increase our understanding of the political and non-political forces driving biased in macroeconomic variables, and the extent to which such forces distort fiscal decisions. Using the quarterly data from FocusEconomicus for eleven Latin American countries over the period 2000-2012, we find that private forecast errors are not over-optimistic, and the private forecast errors are larger in commodity countries than in non-commodity countries.

CUSRR

Session ID:

P-11

Abstract Title:

Industrialized Rivers: A History of Russian Ingenuity and its Consequences

Presenting Author(s): Sydney Hammond ('14)

Other Authors: Paul R. Josephson

Department: Department of History, Colby College, Waterville, ME

Abstract:

The Russia Federation, at over 17 million square kilometers, is the largest country in the world, but with only 142.5 million inhabitants. It borders 14 nations with a geography that includes low plains, tundra forests, and mountainous landscapes. Arable land makes up a mere 7.11% of the available terrain, creating difficulties for agricultural growth and resulting in insufficient food resources. Water resources are extensive, however, including 14 major rivers, many of them in the top 20 of rivers of the world in annual flow. Russian leaders from the mid-19th century to the present have sought global power in part through taming natural resources. They have pursued melioration, hydroelectric, extraction and other projects with significant and irreversible impacts on the environment in the name of economic and technological gains.

The major rivers of Russia are no exception to human manipulation and have been utilized for capitalist – and then socialist – gain for centuries. Often referred to as the "arteries" of Russia, the Amur, Angara, Dvina, Ob, and Volga have provided habitable lands with access to irrigation; agriculturally rich soils; fisheries that supplied both food and trade exports; more direct trade and general transportation routes; defense from enemies through the protection of frigid, surging waters; and later electrification of the nation by way of hydroelectric power plants. These five rivers offered seemingly endless resources for the "Motherland." However, overzealous national campaigns for technological growth resulted in hubristic engineering projects. Projects for the transformation of rivers into machines enabled the Russia and Soviet people to pursue global superiority, directly and indirectly proving the nation's scientific capabilities and increasing her economic standing. At the same time, the government's obsession with speed and progress jeopardized hundreds of thousands of Russian lives and aimlessly destroyed natural resources at lightning speed, all in the name of productivity and technological modernism, as this comparison of economic growth and environmental change on the Dvina, Volga, Ob, Angara and Amur rivers demonstrates.

CUSRR

Session ID:

P-12

Abstract Title:

Precious Cargo: The Gifts of Ethnic Diversity and Islam that Africans brought to the North American Continent

Presenting Author(s):

Tionna C. Haynes ('15)

Other Authors:

Cheryl Townsend Gilkes

Department:

Department of Sociology, Colby College, Waterville, ME

Abstract:

My research has been to find the names of the different groups of Africans that to the New World via the Transatlantic slave trade. The goal of this project is to (1) identify the names of ethnic groups brought to the U.S.A. (2) show that some of these ethnicities embraced Islam and brought that religion with them to the New World, (3) show how the Islamic faith may have aided some African ethnic group's survival during enslavement, and (4) see what aspects of absorbed into Afro-American and American culture. This research debunks the notion that all Africans were the same, got along, and immediately gravitated towards Christianity. The ethnic diversity among the Africans that were enslaved in the United States contributed to slave culture, U.S. history, and U.S.-American current culture. This research reveals the narratives that weren't taught to us in our K through 12 educations. By reading multiple books, I am weaving together the narratives of different ethnicities. So far I have a list of over 50 ethnic groups that were enslaved in the slave trade. Certain groups were inherently Muslim, and there is evidence that they practiced on plantations. Our community has the opportunity to inquire about this information. For our institution, it furthers the scholarship we have on African-American culture and it legitimizes Colby's interdisciplinary African-American Studies program.

CUSRR

Session ID:

P-13

Abstract Title:

Innate Immune Response of Phagocytic Cells in Zebrafish Exposed to Ethanol

Presenting Author(s):

Erik Holmsen ('15) and Antoinette Newton-Acquah ('16)

Other Authors:

Paul Macklis ('15) and Lynn Hannum

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Studies have shown that acute and chronic ethanol exposure can have adverse effects on the mammalian immune system, due mainly to decreased efficiency of certain white blood cells. Neutrophils and macrophages, two major components of the innate immune system, act as the bodies' first line of defense against infection through the processes of phagocytosis and respiratory burst. Phagocytosis involves the engulfment of a foreign pathogen by white blood cells; it is followed by destruction of the pathogen using reactive oxygen species (such as hydrogen peroxide). Our lab is exploring the use of zebrafish, an increasingly popular species for immunology research, as a model to study the effects of ethanol on immune system function. The goal of our current work is to determine the effect of acute ethanol exposure on respiratory burst activity. White blood cells were harvested from the kidneys of zebrafish exposed tank water containing 1% ethanol for 1 or 2 hours, as well as control fish. The cells were counted, plated, and exposed to both physiological (zymosan) and artificial (PMA) stimulants of respiratory burst. A chemical that fluoresces in the presence of hydrogen peroxide was introduced to the cells and the respiratory burst activity was then measured using a fluorescence plate reader. Stimulation index values were calculated for comparison purposes. Initial trends suggest that there is an inverse relationship between the duration of ethanol exposure and the respiratory burst activity of the white blood cells.

CUSRR

Session ID:

P-14

Abstract Title:

Direct Inhibition of Lye by Bacterioopsin

Presenting Author(s):

Kyle F. Hughes ('14)

Other Authors:

Ronald F. Peck

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Microorganisms have evolved to populate every crevice of the earth, coping with environment conditions that many deem uninhabitable. For example, Halophilic archaea can live in extremely high salt concentrations and also produce integral membrane protein complexes, bacteriorhodopsin, to absorb energy from sunlight for ATP production whenever they are in conditions with low oxygen. Bacteriorhodopsin contains the light-sensitive cofactor retinal, a key compound that allows the protein complex to transform solar energy to metabolic energy for the cell. Recently, it has been shown that the biosynthetic pathway of retinal in *Halobacterium salinarum* is regulated by the amount of bacterioopsin present within the cell. Lycopene, a precursor to retinal, can also be converted to bacterioruberin, a process catalyzed by the lycopene elongase (Lye) enzyme. In the presence of bacterioopsin, Lye is inhibited and retinal is made so that the cell can form more bacteriorhodopsin. When no bacterioopsin is present, Lye shunts lycopene toward bacterioruberin production. To determine whether bacterioopsin inhibits Lye directly or indirectly, we added amine-reactive crosslinkers to determine if bacterioopsin and Lye can be covalently bound to one another, suggesting a direct protein-protein interaction (PPI) rather than an indirect interaction in which other proteins may be involved. We can analyze this PPI by replacing the gene encoding Lye protein with one that includes an epitope tag on the N terminus. Specific antibodies attached to beads will then bind to Lye, a common procedure known as immunoprecipitation. With crosslinking, this immunoprecipitation would also allow us to identify Lye-associated proteins. To assess our immunoprecipitation protocol, we isolated a protein, brp, but have yet to confirm its identity. Furthermore, because bacterioopsin and Lye protein are both transmembrane proteins and the crosslinkers we add are membrane impermeable, the topology of these proteins can be clearly mapped out after trypsin-digest and mass spectrometry analysis.

CUSRR

Session ID:

P-15

Abstract Title:

Regulation of Wing Size and Patterning in True Bugs

Presenting Author(s):

Alice Grubb Jones ('14)

Other Authors:

David R. Angelini

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

The importance of regulating appendage development usually goes unnoticed. Genes are expressed and suppressed to make sure your left and right legs are the same length and your thumb develops differently from your index finger. Our research examines allometry, the regulation of organ size compared to body size, in the study of wing growth and patterning in two species of Heteroptera (true bugs), *Jadera haematoloma* and *Oncopeltus fasciatus*. *J. haematoloma* exhibit wing dimorphism, where they develop one of two distinct wing phenotypes. There are benefits and drawbacks to each phenotype; only the long-winged bugs have the ability to fly, while the short-winged bugs generally produce more offspring. This dimorphism provides a great case study for regulations of allometric wing size and how nutrition, hormones, and genetics might affect wing growth. *J. haematoloma* also have unique wing patterning, with species and individual-specific variation in vein placement. *O. fasciatus* has a long-winged monomorphic phenotype, which acts as a useful comparison between wing development in true bugs.

We have identified candidate genes for our research from studies in fruit flies, since many pathways are conserved between these insects. Since there is no sequenced genome for our true bugs, we usually clone genes of interest using degenerate PCR. We test gene functions at various life stages by RNA interference, and will eventually use in situ hybridization and qPCR to determine gene expression patterns. We are compiling a database of morphological measurements that track the growth of wings and other structures in control and RNAi specimens. We have already identified *Distal-less* as a gene involved in the development of the distal portion of wings, and we hope to describe in detail the roles of this and other genes to provide an understanding of allometric growth and dimorphism.

CUSRR

Session ID:

P-16

Abstract Title:

In Your Face: Effects of an Aromatic Shielding

Presenting Author(s):

Abebu Kassie ('14)

Other Authors:

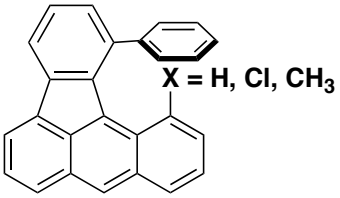
Rachel Sirois and Dasan M. Thamattoor

Department:

Department of Chemistry, Colby College, Waterville, ME

Abstract:

This work describes our effort to synthesize compounds such as **1** (**X** = H, Cl, CH_3). The aim of the project is to investigate the shielding effects of the phenyl ring on the group **X**. The X-ray structure of **1** and computational studies, using modern techniques, will be also performed to better understand the structures and spectroscopic properties of these compounds.



1

CUSRR

Session ID:

P-17

Abstract Title:

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

Presenting Author(s):

Thabiso Kunene ('15)

Other Authors:

Max Cushner ('13), Thora Maltais ('09), Mark Ziffer ('11), and Rebecca R. Conry

Department:

Department of Chemistry, Colby College, Waterville, ME

Abstract:

Compounds or complexes combining an organic (carbon-containing) species and a copper ion are amongst the most widely used organometallic reagents in synthetic organic chemistry. However, the chemistry for such organocopper compounds is underdeveloped including that for copper(I)-arene complexes, which are quite rare. Nonetheless, once the chemical properties of such copper-arene complexes are better understood, it will be easier to find uses for them, for instance as catalysts.

Previous work on this project has produced evidence that copper(I)-arene complexes bearing phenyl and naphthyl groups behave differently from one another in arene replacement reactions. Thus, the phenyl does not seem to bind as strongly to the copper ion as the naphthyl in solution and also the data have suggested that the binding site of the copper ion to the phenyl and the naphthalene group might be different. Hence, the goal of this project is to synthesize and characterize new copper(I) complexes with large ring (macrocyclic) ligands that have appended arene groups (phenyl, naphthyl) in order to probe the factors that contribute to the strength and selectivity of the copper-arene bond. This project is performed in collaboration with Max Cushner, who is studying a copper(I)-naphthyl complex whereas I am targeting the copper(I)-phenyl complex shown in figure 1.

The synthesis of the macrocyclic ligand with an appended ethyl phenyl group requires four steps, and another two steps are needed to make the target Cu(I)-phenyl complex. Some of these steps require oxygen-and/or water free conditions, necessitating the use of special synthetic techniques. The properties of the target complex will be studied using a variety of characterization techniques and the progress towards this synthesis will be discussed.

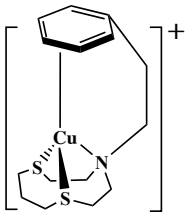


Figure 1: Drawing of the target copper(I)-phenyl complex

CUSRR

Session ID:

P-18

Abstract Title:

Voices of the Vanguard: An Oral History of Black Women in the Twentieth Century

Presenting Author(s):

Lauren Lacy ('14)

Other Authors:

Cheryl Townsend Gilkes

Department:

Department of Sociology, Colby College, Waterville, ME

Abstract:

Decades before the Women's Liberation Movement came to public attention, African-American women were already achieving its goals. The Radcliffe College Black Women Oral History Project records the impressive lives of 72 women, and their achievements in the first half of the Twentieth Century. Their accomplishments encompass a wide range of mediums, such as educational advancement, including two of the first African-American women to earn PhDs (both in 1921), as well as successful professional lives, with careers in medicine, law, business, government work, education, and numerous other fields. These women also affected social change on local, regional and national levels, working in the labor movement, for Civil Rights, through volunteer services, and in religious organizations.

Despite their success, these women are overlooked in many historical narratives. Because their accomplishments span a variety of mediums and goals, they cannot be neatly packaged into a historical movement, such as Civil Rights or Women's Liberation. In order to get a fuller, more accurate, narrative of American society, it is crucial to examine intersectionality in America. It is crucial to not only examine marginalized groups, but also the interaction between these identities and their unique responses to the dominate culture.

CUSRR

Session ID:

P-19

Abstract Title:

The Quest for an Enzyme-Regulating Motif in Extremophilic Microbial Opsins

Presenting Author(s):

Sarah K. Lane-Reticker ('16)

Other Authors:

Ronald F. Peck

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Basic survival on planet Earth is highly dependent upon an organism's ability to convert available resources into energy, and to do so in the most efficient manner possible. Organisms living in extreme environments with limited resources must develop specific regulatory mechanisms to avoid unnecessary energy use. The salt-loving archaeon *Halobacterium salinarum*, produces a light-induced proton pump called bacteriorhodopsin to provide energy when oxygen levels are low. Bacteriorhodopsin (BR) is comprised of an apoprotein, bacterioopsin (BO), and a retinal cofactor. Its production begins when low oxygen levels trigger transcription of the *bop* gene, which encodes bacterioopsin. At the same time, lycopene must be converted to β-carotene, which is then cleaved to produce retinal. When cells do not require BR, lycopene elongase (Lye) converts lycopene to bacterioruberins, which are pink carotenoids that reinforce the cell membrane and protect from UV radiation. Our lab previously determined that the presence of BO inhibits Lye activity to allow the available lycopene to be used for retinal synthesis. In this study, we describe a research approach to test a variety of truncation and point mutations to identify the portion of BO responsible for these regulatory properties. We replace wild-type *bop* in *H. salinarum* with a mutated version, and analyze carotenoid production levels to see if the mutated bacterioopsin will inhibit Lye. An understanding of the binding motif will provide insight into protein interactions within the cell membrane, which has not been studied in great depth. The mechanism is expected to differ from binding mechanisms in the cytoplasm since the environment is hydrophobic as opposed to hydrophilic.

CUSRR

Session ID:

P-20

Abstract Title:

Twisted Phenanthrenes

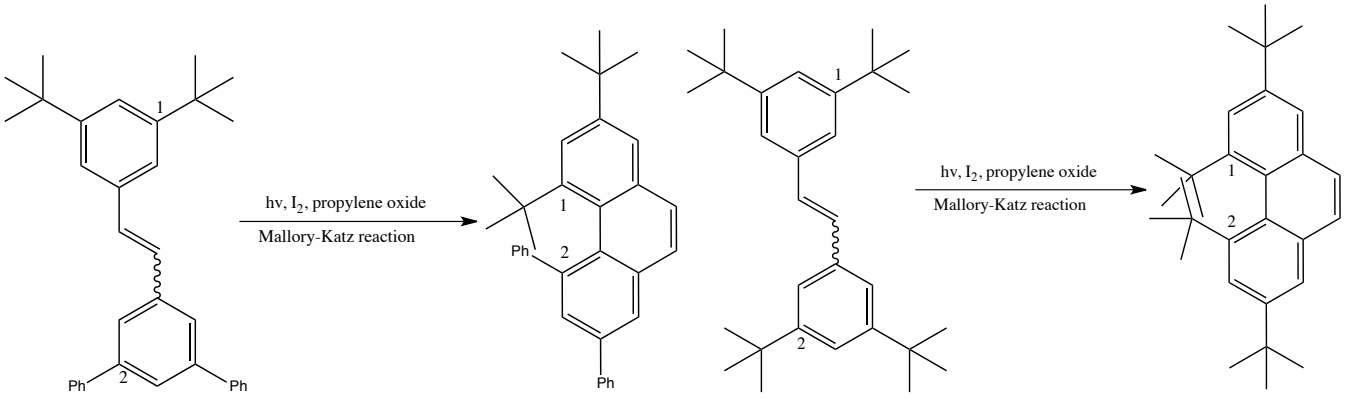
Presenting Author(s): Olek Lato ('15)

Other Authors: Dasan M. Thamattoor

Department: Department of Chemistry, Colby College, Waterville, ME

Abstract:

Phenanthrenes are 2-dimentional molecules consisting of three benzene rings. This project aims at placing large substituents at positions 1 and 2 to induce a 3-dimentional twist in the structure of the molecule. The two goal substituent pairings for these positions are a phenyl and tertiary butyl group, and two separate tertiary butyl groups. These pairings are accessible via Wittig reactions and the Mallory-Katz reaction. Successfully accomplishing these pairings would create an unprecedented level of twist for phenanthrene molecules. Additionally, it is our goal in the second pairing of two tertiary butyl groups to cause enough sterical hindrance such that the groups stop spinning, and each methyl group appears as a separate peak on an ^{1}H NMR spectrum. A typical tertiary-butyl group appears as a single strong peak, but successfully synthesizing this molecule, and halting the bond rotation of the three methyl groups, would be the first recorded instance of tertiary-butyl methyl group isolation on an NMR spectrum.



CUSRR

Session ID:

P-21

Abstract Title:

Circadian Rhythms: Timeless Expression

Presenting Author(s):

Abby Lebowitz ('15) and Jocelyn Thomas ('16)

Other Authors:

Dan Totten ('14), Devin Gibbs ('14), Jarildy L. Javier ('16), Mayra Arroyo ('16), Ariel Oppong ('16), and Andrea Tilden

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Circadian rhythms are endogenously driven cycles that operate on an approximately 24-hour clock and entrain organisms to their environments. For example, sleep-wake cycles can typically be prompted by light-dark stimuli. At the cellular level, molecular processes of protein transcription, translation, and negative feedback drive circadian rhythms. Many circadian rhythm proteins are phylogenetically conserved in organisms as diverse as bacteria and humans. Essentially nothing is known about the molecular mechanisms of circadian rhythms in crustaceans. With the very recent publication of the first complete crustacean genome in 2010 (the water flea *Daphnia pulex*), we now have access to the bioinformatic tools to explore these mechanisms.

The purpose of our research is to determine the location and patterns of expression of circadian rhythm proteins in a variety of crustaceans with diverse ecological profiles, for example freshwater versus marine, and aquatic versus intertidal. In this study we specifically focused on a protein called timeless. Timeless is a gene in Drosophila that encodes TIM, an essential protein that regulates circadian rhythms. Timeless mRNA and its protein oscillate rhythmically with time as part of a transcription-translation [negative feedback] loop involving the period gene and its protein.

We are using immunohistochemistry with fluorescent labeling to localize timeless expression to specific tissues, structures, and times of day. We are using whole-mount *Daphnia* and dissected neural tissues from *Uca pigulatora (Fiddler Crab)* for cell culture and whole-tissue staining.

CUSRR

Session ID:

P-22

Abstract Title:

Personality Change You Can Believe In: Concurrent and Prospective Relations between the Big Five Personality Traits and Subjective Well-Being

Presenting Author(s):	*Other Authors:*
Josephine Liang ('14) and Anna Kronauer ('16)	Christopher J. Soto

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

How do people's personality traits influence their happiness, and how does being happy impact the development of personality traits? The present study aimed to gain a more thorough understanding of the longitudinal relations between personality traits and subjective well-being.

A nationally representative sample of 16,367 Australian adolescents and adults participated in a four-year longitudinal study, with annual waves from 2005 to 2009. These participants completed measures of the Big Five personality traits (Extraversion, Neuroticism, Openness to Experience, Agreeableness, and Conscientiousness) and three key aspects of subjective well-being (life satisfaction, positive affect, and negative affect). Previous research has established that people with extraverted, agreeable, conscientious, and emotionally stable personalities tend to experience higher subjective well-being, and that changes on these same traits are associated with fluctuations in well-being. However, the present study is one of the first to test for the source of these correlations: whether personality traits predict change in well-being, whether well-being predicts personality change, or both.

Using latent autoregressive models, our results show both prospective trait effects and prospective well-being effects. Specifically, people who were initially extraverted, agreeable, conscientious, and emotionally stable tended to subsequently increase in well-being. Conversely, people who initially experienced high levels of well-being tended to become more agreeable, conscientious, emotionally stable, and introverted over time.

These findings advance our understanding of the relations between personality traits and subjective well-being. They show that neither traits nor well-being are set in stone, and that traits and well-being reciprocally influence each other. Our results also have broader implications, suggesting that it may be possible to initiate a virtuous cycle of positive changes in both personality and well-being. For example, therapeutic or community-wide efforts to increase people's sense of well-being may result in generally positive changes in personality traits. These personality changes, in turn, may further increase happiness.

CUSRR

Session ID:

P-23

Abstract Title:

Characterization of Ethanol Metabolism in Circadian Rhythm Defective *Drosophila period* Mutants

Presenting Author(s):

Jennifer Liao ('15) and Laura W. Morin ('14)

Other Authors:

S. Tariq Ahmad

Department:

Department of Biology at Colby College, Waterville, ME

Abstract:

Circadian rhythms define an organism's daily sleep-wake cycle and can have a profound effect on changes in metabolic activity. Mutations in the *Drosophila period* gene result in circadian periods, which are arrhythmic (*per0*), longer (*perL*), or shorter (*perS*) as compared to wild type. Ethanol exposure causes disruptions in a variety of physiological processes including circadian rhythm. Behavioral responses to ethanol include sedation, recovery and tolerance after repeated exposure. Ethanol is mainly metabolized by alcohol dehydrogenase (Adh), an enzyme that converts alcohol to aldehyde. This study aims to characterize a baseline for ethanol metabolism in period mutants by measuring behavioral responses and Adh activity. Behavioral response to ethanol was measured using a sedation assay in which flies were exposed to alcohol over time until 50% of flies were sedated. Recovery was measured by observing the time until 50% of flies recovered, and tolerance was determined by exposing flies to ethanol 24 hours after the initial sedation. We also measured Adh activity as a parameter for a metabolic response to ethanol. *perL* had a shorter sedation time, longer recovery time and developed less tolerance compared to wild type. *per0* had a higher sedation time, faster recovery time and more tolerance than wild type flies. No significant differences were found between *perS* and wild type. Adh activity was lower in *perL* and higher in the *per0,* while activity in *perS* did not show a remarkable difference. This data suggests a correlation exists between Adh activity and behavioral responses to ethanol exposure. This study proposes an interesting link between circadian periods, ethanol metabolism and behavioral responses to ethanol.

CUSRR

Session ID:

P-24

Abstract Title:

Characterization of Deficiency in Innate Locomotion in a Rotenone Induced Parkinson's Disease Model of *Drosophila*

Presenting Author(s):

Laura W. Morin ('14) and Jennifer Liao ('15)

Other Authors:

S. Tariq Ahmad

Department:

Department of Biology at Colby College, Waterville, ME

Abstract:

Parkinson's disease is a neurodegenerative disorder that results from the degeneration of dopaminergic neurons in the central nervous system, primarily in the substantia nigra. The disease causes motor deficiencies, which present as rigidity, tremors and dementia in humans. Rotenone is a ketonic chemical compound generally used as an insecticide because it causes oxidative damage by inhibiting the function of the electron transport chain in mitochondria. It is also used to induce Parkinson's disease in the *Drosophila* model and causes early mortality. Flies have an inherent negative geotactic response, which compels them to climb upwards upon being startled. It has been established that rotenone causes motor defects that disrupts the flies' ability to climb after they have been tapped downwards. This study aimed to characterize the effect of rotenone exposure on the flies' undisturbed innate locomotion. Flies were raised on various dosages (125 μM, 250 μM, and 500 μM) of rotenone-supplemented food for 7 days. Startle response was determined in order to establish the efficacy of the rotenone-mediated locomotion defects. Undisturbed locomotion was then measured using a *Drosophila* activity monitor, which tracked the movement of individual flies over a period of 7 days. Flies exposed to rotenone exhibited a dose-dependent startle response defect with significant differences in climbing ability compared to control past a dosage of 250 μM after 3 and 7 days. Innate locomotion data will be presented. This study will improve the understanding of rotenone induced motor deficiencies in a *Drosophila* model of Parkinson's disease.

CUSRR

Session ID:

P-25

Abstract Title:

Understanding What Information Visitors Learn Upon Visiting the Maine Lakes Resource Center and the Most Successful Marketing Techniques Used to Portray the Message of Conservation

Presenting Author(s): Ellie Linden ('14)

Other Authors: F. Russell Cole

Department: Environmental Studies Program, Colby College, Waterville, ME

Abstract:

The Maine Lakes Resource Center has become a popular place for Belgrade residents and tourists to explore and to learn about the surrounding lakes. Colby has a close partnership with the Belgrade watershed by conducting research through several academic departments, recently adding a buoy on Great Pond that sends water quality information back to campus. The Maine Lakes Resource Center is known as the "land buoy" that connects people to their environment, provides information to the public on how they can have lake-friendly properties, and provides feedback on how effective the message of conservation is portrayed. The aims of this study are to find out what information people are interested in when visiting the center and which marketing techniques seem to be most successful. The amount of each flier, brochure, and "zine" (miniature magazine) that is taken by the visitors will be recorded in order to understand what people are getting out of the center. In addition to counting which information is taken, surveying the visitors about their experience visiting the MLRC will provide feedback on who is coming to the center, what they enjoyed about the experience, and which areas could be improved. Having a greater understanding of what people get out of the resource center is extremely valuable in effectively educating the public on how to help conserve the Belgrade Lakes.

CUSRR

Session ID:

P-26

Abstract Title:

The Belgrade Lakes: Their Impact on Local Culture and the Necessity of Their Preservation

Presenting Author(s): Kathy Lipshultz ('16)

Other Authors: James Fleming

Department: Department of Science, Technology, and Society at Colby College, Waterville, ME

Abstract:

The communities surrounding the Belgrade Lakes were built around the water. For generations, families have created memories on the water, spending years boating, fishing, and swimming. Businesses have continued to succeed even with a struggling economy, remaining open year after year because of the summer tourism. Painters, playwrights, and renowned writers have all found a quaint retreat on the Belgrade lakes. However, the lakes currently face severe environmental threats that could jeopardize many recreational opportunities.

The lakes suffer from increasing water pollution and a growing infestation of non-native plants. Invasive milfoil currently occupies three tributaries of Great Pond, and nearly half of the water body is at high risk. Phosphates from fertilizers continue to leech into the water with little or no buffer zones to block them, risking creating algal blooms that suck oxygen from the water. If the plants spread and the fish die, the ecosystem of the Belgrade lakes will be destroyed.

The people of the Belgrade lakes depend on the water; however, some still fail to realize the extent of its importance. As water quality declines, recreational opportunities disappear, and the surrounding community suffers. Protecting the Belgrade lakes not only preserves a wildlife habitat, but also guarantees the economic stability of hundreds of people, inspiration for artists from across New England, and a way of life for generations to come.

An informational booklet will be created to both describe how the lakes sculpted the culture of the Belgrade area and inform the public how to implement eco-friendly practices and preventative measures. In doing so, it will tie together people's emotional connection to the area with hard facts about the future, thereby providing an incentive for preserving the Belgrade Lakes.

CUSRR

Session ID:

P-27

Abstract Title:

Apoptotic Cleavage of Poly (ADP-ribose) Polymerase by Laromustine

Presenting Author(s):

Vania Lopez ('16)

Other Author

Emily Kaye ('12) and Kevin P. Rice

Department:

Department of Chemistry, Colby College, Waterville, ME

Abstract:

Understanding mechanisms by which anticancer drugs kill cells is crucial to cancer research. Apoptosis, a form of programmed cell death, occurs through a variety of pathways. One of these pathways is marked by the cleavage of a protein called poly(ADP-ribose) polymerase (PARP). The experimental anticancer drug Laromustine, which has been clinically tested against leukemia and brain cancer, may trigger this pathway. Laromustine is a prodrug, which means that its activity in the body is dependent on a chemical rearrangement that happens in cells. The products of these chemical reactions can be studied distinctly using analogs. This project aims to study the cleavage of PARP induced by Laromustine and its analogs. Cleaved PARP is measured via Western Blotting, a technique by which a desired protein is quantified from the extracts of cultured human cancer cells using specialized molecules called antibodies. Preliminary data suggest that an apoptosis pathway involving PARP cleavage is indeed part of human leukemia cells' response to Laromustine in therapeutically relevant dose ranges. A more detailed picture of the drug's mechanism of action is emerging. Understanding this apoptotic pathway could lead to a better understanding of Laromustine, and also help develop more effective treatments for cancer.

CUSRR

Session ID:

P-28

Abstract Title:

The Effects of Acute Ethanol Exposure on the Innate Immune System

Presenting Author(s):

Paul Macklis ('15)

Other Authors:

Kaitlin Curran ('14) and Lynn Hannum

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Acute and chronic alcohol consumption have been linked to susceptibility to infection in humans. There is evidence that ethanol modifies the activity of mammalian white blood cells, key components of the immune system. Of particular interest are the macrophages and neutrophils, cells that phagocytose (engulf) disease-causing microbes and degrade them through a process known as respiratory burst. In a study that used mice as the model organism the number the bacteria engulfed by macrophages decreased after three hours of exposure to ethanol. Although the zebrafish is rapidly gaining popularity as a model for human immune function and disease, no studies have been conducted to determine whether ethanol influences zebrafish macrophage and neutrophil function. In our study, adult zebrafish were immersed in environments of 1% ethanol for one and two hours. Two metrics were used to analyze immune cell efficacy following the ethanol exposure: the percentage of phagocytic cells that internalized *E. coli* bacteria and the relative number of *E. coli* that were phagocytosed per cell. Both metrics were interpreted through flow cytometry. Previous work conducted in professor Hannum's laboratory suggests that there is a relationship between the time of day and the efficacy of the immune system, with the largest differences occurring at 10 AM and PM. Therefore, the experiments were conducted at both 10 AM and 10 PM to observe any differences due to time of day. Trends in the preliminary results suggest that the innate immune system experiences a decrease in activity after one hour of ethanol exposure at 10 AM. In contrast, exposure to ethanol at 10 PM does not appear to produce as significant a decrease in innate immune activity. Future research will seek to determine which type of cells, neutrophils or macrophages, are most affected by the ethanol inhibition.

CUSRR

Session ID:

P-29

Abstract Title:

Assessing LakeSmart Evaluations from 2009 to 2012 in the Belgrade Lakes Region of Central Maine

Presenting Author:

Sarah Madronal ('14)

Other Authors:

Samantha Lovell ('16), Noah Teachey ('13), Philip Nyhus, Maggie Shannon, David Gay, F. Russell Cole, Catherine Bevier, and D. Whitney King

Department:

Environmental Studies Program, Colby College, Waterville, ME

Abstract:

Lakes are important economic and recreational resources in Maine that provide numerous ecosystem services, including drinking water and habitat for fish and wildlife. A growing number of Maine's 5,785 lakes face declining water quality. In 2004, the Maine Department of Environmental Protection established LakeSmart, a state-wide effort to engage communities in lake conservation. In 2012, management of this program was transferred to the Maine Congress of Lake Associations. In this study we summarize preliminary results of our findings from an analysis of 219 LakeSmart certification evaluations from 17 screeners at 7 locations from 2009-2012 in the Belgrade Lakes region of central Maine. Since 2009 on average 31 new evaluations were added each year. Total average score of the evaluations was highest in 2009 (84%) and lowest in 2011 (78%). Long Pond and Great Pond accounted for 95% of all evaluations and three screeners accounted for 46% of all evaluations. Forty percent evaluations resulted in commendations. Between 10% and 34% of evaluations were within 2 points above the passing score of any individual section while between 3% and 8% were within 2 points below the passing score. Our poster represents preliminary results of an ongoing study on LakeSmart in the Belgrade Lakes watershed that will also explore factors associated with the spatial distribution of these evaluations.

CUSRR

Session ID:

P-30

Abstract Title:

The Butterfly Effect: Analyzing Abundance and Diversity of Butterflies in Costa Rica

Presenting Author(s): Omari Matthew ('14)

Other Authors: Ari Porter ('15), Julia Rogers ('16), Susie Gagliardi, and Cathy D. Collins

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Due to a past attempt to create a bamboo plantation at the Firestone Center for Restoration Ecology in Costa Rica, the property has deviated from the native tropical rainforest that once dominated. With the intention of restoring the property back to its natural state, we have designed several studies centered on 16 experimental plots that vary in tree diversity and soil nutrients. This particular study consists of capturing butterflies and analyzing them to determine both baseline information and initial differences among our experimental sites, giving us more information regarding restoration at Firestone. Specifically, we ask: What is the diversity and abundance of butterflies in our experimental landscape. To answer our question, we set up butterfly traps within and between experimental plots. The traps were baited with a cocktail of native fruits and beer, and surveyed about 24 hours after each baiting. We then captured, photographed, and marked the butterflies based on their capture site. In addition to gaining information on butterfly abundance and diversity, our results, in concert with the data collection from our other studies, will allow us to gauge how our experimental manipulations may have shifted these measurements. Our results may also suggest that butterfly abundance and diversity is indicative of rainforest health and restoration progress. Furthermore, this experiment could allow us to determine whether or not mark and recapture techniques are a suitable method for estimating butterfly population size at our site. This would give us and possibly other conservationists, another avenue for monitoring rainforest restoration.

CUSRR

Session ID:

P-31

Abstract Title:

Analyzing Bacterioopsin Inhibition of Lycopene Elongase Enzyme in *Halobacterium volcanii*

Presenting Author(s):

Gracey McGrory ('15)

Other Authors:

Ronald F. Peck

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

All organisms have specialized cellular mechanisms that combat environmental stressors. The extremophile *Halobacterium salinarum* is a species of Archaea that must generate energy under conditions of low oxygen levels and prevent DNA damage from UV light. Specifically, the molecule bacterioruberin absorbs high spectrum light and bacteriorhodopsin functions as a light-driven proton pump in anaerobic situations. Both are derived from multi-step pathways beginning with the molecule lycopene. Bacterioruberin is initially catalyzed by the *lye* enzyme; bacteriorhodopsin is produced when the *bop* gene encodes the protein bacterioopsin (BO), which pairs with its cofactor, retinal. Previous research indicate that BO inhibits *lye* in *H. salinarum* to promote the production of retinal and halt that of bacterioruberin, but the mechanism of this regulation remains poorly understood. *Haloferax volcanii* serves as a model organism to examine this interaction because it is easily grown in a laboratory setting and likely does not produce factors that would influence a BO-mediated system. To test for the presence of lycopene, bacterioruberin, or bacteriorhodopsin, we analyzed the mass spectrum of *H. volcanii*. A Δ*lye* strain only produced lycopene. When the *H. salinarum lye* and *bop* were introduced to this strain, lycopene and trace amounts of bacterioruberin were produced. In contrast, the strain with its natural *H. volcanii lye* and the addition of *bop* produced bacterioruberin, not lycopene. These results indicate that BO inhibits lye from *H. salinarum* rather than lye from *H. volcanii*, providing evidence for a direct mechanism. A protein promoting the production of its cofactor by mediating enzyme inhibition is a novel mechanism that may be identified in other protein complexes throughout life.

CUSRR

Session ID:

P-32

Abstract Title:

Chemistry Out of This World: Generation of Propadienylidene

Presenting Author(s):

Megan S. Michie ('15)

Other Authors:

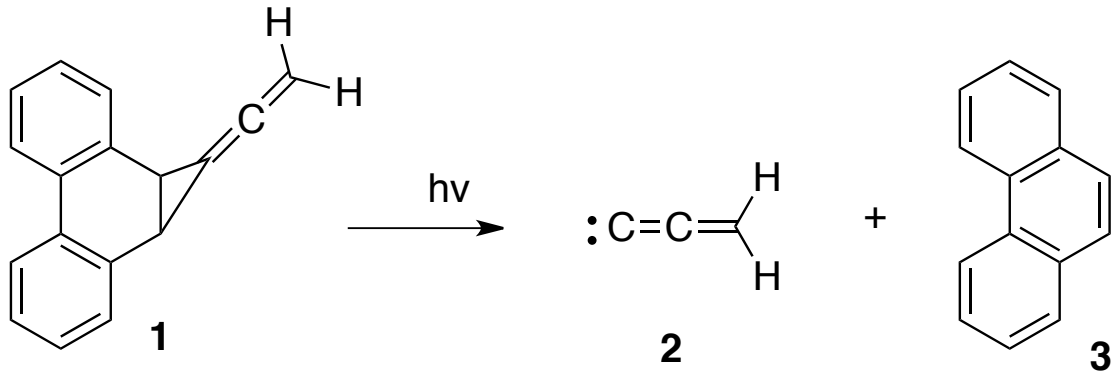
Victor Klinkerch and Dasan M. Thamattoor

Department:

Department of Chemistry, Colby College, Waterville, ME

Abstract:

This project aims to synthesize propadienylidene (**2**) using solution-based methods instead of argon matrix isolation that has been done traditionally. This species has been detected in large quantities in outer space and is of great interest to physicists and astronomers as well as chemists. Therefore, a simpler synthetic route could have a wide range of implications. Propadienylidene is a carbene, an unstable reactive intermediate containing a carbon with two unshared valence electrons. The presence of the allenic functionality (two adjacent double bonds) also contributes to the carbene's instability, thereby increasing the challenge of generating this species. Our proposed approach involves developing a cyclopropanated-phenanthrene precursor (**1**) that photolysis will break down into the desired carbene (**2**) and phenanthrene (**3**), whose high level of stability drives the reaction.



CUSRR

Session ID:

P-33

Abstract Title:

Anything You Can Do, I Can Do Better: Comparing Choline Supplementation in Two Rat Strains

Presenting Author(s):

Astrid S. Moore ('15)

Other Authors:

Molly Robertson ('15) and Melissa J. Glenn

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

Beyond appearances, physical and psychological differences divide Long Evans and Sprague Dawley rat strains. Long Evans rats demonstrate significantly better spatial navigation performance and higher quality of movement than Sprague Dawley rats. The aim of the present study was to investigate how adolescent choline supplementation changes performance in tests of spatial reference memory, object recognition memory and anxiety. Choline supplementation in Sprague Dawley rats enhances cognition and reduces anxiety, but the effects of these dietary factors on Long Evans rats are undocumented. Therefore, our goal for the present study was to observe the general differences between these strains and the impact of choline on them on a battery of behavioral. We predict that Long Evans rats will show higher performance on all behavioral tasks, and that their performance and levels of anxiety will be less benefited by adolescent choline supplementation compared to the Sprague Dawley rats. This research will expand our understanding of the generalizability of the effects of choline supplementation.

CUSRR

Session ID:

P-34

Abstract Title:

Variable Leaf Milfoil and Invasive Plant Management in Great Pond and Long Pond

Presenting Author(s): Andrew Newcomb ('15)

Other Authors: F. Russell Cole

Department: Department of Environmental Studies, Colby College, Waterville, ME

Abstract:

Variable Leaf Milfoil (*Myriophyllum heterophyllum*) is an invasive aquatic plant present in 18 Maine water bodies. The plant itself is native to the southeastern United States and so has no natural predators in Maine and is able to out-compete all native plants, including native milfoils. Within the Belgrade Lakes it has completely infested Messalonski Lake and parts of Great Pond. The infestation in Great Pond began in the Great Meadow Stream which flows into North Bay and which is the site of the current mitigation efforts. Small infestations have also been found in Robbins Mill Stream, Swann's Brook and Rome Trout Brook (minor tributaries of the lake). Working with the Belgrade Regional Conservation Alliance (BRCA) I have headed a new program called Adopt A Shoreline. The goal is to educate lakefront property owners on Great and Long Ponds how to identify invasive milfoil and to how to patrol their own shoreline so that the littoral of the entire lake can be constantly monitored. Conducting these workshops has provided great insight into the mindset of property owners in the Belgrade watershed, as well as the difficulties faced by non-profits in organizing community support for environmental causes. This program, combined with the efforts of two low impact pulling crews (BRCA staff and the professional SCUBA team New England Milfoil) working in North Bay and Great Meadow Stream has thus far been able to slow the spread of milfoil. All activity has been tracked and mapped using ArcGIS, from which I have gathered data on the extent of the survey and pulling efforts as well as the Adopt A Shoreline program. This combined approach on Great Pond and Long Pond, if success continues, is to be used as a model for managing milfoil infestations by other lake associations facing this problem.

CUSRR

Session ID:

P-35

Abstract Title:

Measuring Iron in the Ocean Using Preconcentration and Flow Injection Analysis with Chemiluminescence Detection

Presenting Author(s):

Ryan C. Newell ('14)

Other Authors:

Juan Morotti ('15), Kimara F. Nzamubona ('14), Madhira Gammana, Valerie Smith, Kaiya Hansen, Mark Wells, Carl Tripp, and D. Whitney King

Department:

Department of Chemistry, Colby College, Waterville, ME

Abstract:

Iron is the limiting reagent for phytoplankton growth in large areas of the ocean. Phytoplankton fix between 30-40% of the global carbon dioxide sequestered by plants, so small changes in their productivity could have a large impact on climate. Iron is very difficult to measure at the trace concentrations in the ocean so the global distribution of iron is poorly characterized. The goal of this project is to achieve picomolar detection limits with a simple method that could eventually be used on research voyages. Seawater is pumped through a column containing the Fe(III) ligand desferrioxamine-B (DFB) where it is concentrated and then eluted off the column in a reduced volume of oxalate. The iron oxalate is then measured by flow injection analysis with chemiluminescence. Iron oxalate reacts with hydrogen peroxide to produce superoxide and hydroxyl radical that both produce chemiluminescence when reacted with luminol. This analytical system allows provides lower detection limits for iron by concentrating the analyte, and enhancing the chemiluminescence reaction with the iron oxalate complex.

CUSRR

Session ID:

P-36

Abstract Title:

Effects of Buffering Shoreline Development on Shoreline and Sediment Composition in the Belgrade Lakes Watershed

Presenting Author(s):

Gian Perani ('14) and Sophie Weaver ('14)

Other Authors:

Catherine Bevier and F. Russell Cole

Department:

Department of Biology and Environmental Studies Program, Colby College, Waterville, ME

Abstract:

In theory, buffer strips and other environmental landscape practices along lake shorelines reduce the impact of development on lake water quality and help protect lake health by reducing nutrient and sediment loading. Transformation of shorelines from natural forested and wetland cover to more impervious surfaces can affect littoral environments by influencing sediment characteristics, nutrient loading, habitat structure, and biological diversity. To better understand the effects of shoreline development in the Belgrade Lakes region of central Maine, sites associated with developed properties, with and without lake-friendly landscaping, and adjacent sites associated with undeveloped shoreline, or reference sites, on Great Pond, North Pond, and East Pond were surveyed. Lake-friendly developed and reference sites were not different in most measures of riparian quality, and provided significantly more shading and heterogeneous vegetation along the shoreline. In contrast, sites developed without natural landscaping exhibited significantly less shading and less tree cover. The ponds of interest have inherent differences in their geology, which are reflected in the substrate composition. However, the sediment of all sites at both 0.5M and 1.0M water depths in Great Pond, North Pond, and East Pond is heavily dominated by sand. The differences present are small within a particular pond and inconsistent when looking across ponds. Sediment loading, therefore, does not seem to be significantly affected by the presence of a buffer as the silt percentages lack trends. Nutrient loading, however, has yet to be examined and will likely confirm the benefits of buffering lakefront property.

CUSRR

Session ID:

P-37

Abstract Title:

I'm Sure I Saw That Word or Did I? Producing Phonological False Memories of Words

Presenting Author(s):

Grovenia Perryman ('15) and Melissa Preziosi ('15)

Other Authors:

Jennifer Coane

Department:

Department of Psychology, Colby College, Waterville, ME

Abstract:

False memory is defined as remembering an event that did not occur. By studying mistakes in remembering a greater understanding of normal cognitive functioning can be gained.

Past studies (Coane et al., 2007; Roediger & McDermott, 1995) have shown that when a list of words related to a general theme (i.e., bed, rest, tired) is presented, participants will often report seeing one critical word that is highly related to all the words (i.e., sleep) on a subsequent memory test, although this critical item was not in the original list. Words that are related by the same theme are semantically or associatively related; thus, falsely remembering the critical word is considered a semantic false memory. In such lists, the associative strength between the list items and the critical item predict false memories. More strongly associated words (such as black-white compared to teeth-white) increase the probability that a non-studied critical item will be falsely remembered. Association strength is typically measured through free association norms.

In the present study, we are testing if lists of similar-sounding or phonologically related words (i.e., cheap, leap, steep), can produce false memories for one word that sounds similar to all the presented words (i.e., sleep). This type of false memory is known as a phonological false memory. Previous studies of phonological false memory have found that, much like in semantic false memory, a false memory of a similar sounding word can be produced. To develop the lists, we selected items from a free association study conducted in our lab, in which participants generated responses that 'looked or sounded' like a cue. Thus, we are able to control association strength for phonologically similar items while keeping surface similarities (like word spelling and length) constant and we will be able to determine whether association strength predicts false memories as it does in semantic lists. The results of this study will help determine if phonological and semantic false memories are produced by the same mechanism and will further constrain theories of false remembering.

CUSRR

Session ID:

P-38

Abstract Title:

The Role of the BAG3 Gene on the Efficacy of Laromustine's Anticancer Effect

Presenting Author(s): Colin Sheehan ('15)

Other Authors: Kevin P. Rice

Department: Department of Chemistry, Colby College, Waterville, ME

Abstract:

Laromustine is an anticancer prodrug that can induce apoptosis, or programmed cell death, in human cancer cells. An analysis of the effects of Laromustine on genes involved in apoptosis revealed that of the 88 investigated genes, one gene, BAG3, saw its activity significantly increased upon drug exposure. This phenomenon is referred to as "upregulation". The goal of the research described herein is to artificially downregulate BAG3 in cultured human cancer cells and assess whether such cells are more susceptible to the cell-killing action of Laromustine. In order to do so, an approach called transfection is used where specialized DNA molecules are inserted into the cancer cells, which can then cause decreased BAG3 levels. There are different methods for transfection and we are currently using two techniques: electroporation and a chemical-based method. Electroporation is the technique of electrocuting the cancer cells to form pores within the cells. These pores allow the special DNA to flow into the cell. The chemical-based technique utilizes a series of chemicals that are combined to allow the special DNA into the cancer cells. With both techniques, once the DNA is in the cell, it can turn the gene's activity down. At this point, we will run an experiment that allows us to measure the gene activity in the cancer cells, and specifically look at BAG3 activity. Finally, we will perform cell death experiments using Laromustine to assess the effect of decreased BAG3 levels on the efficacy of the drug. If cells with downregulated BAG3 are indeed more susceptible to Laromustine treatment, it is possible that concomitant drug therapies against BAG3 or clinical diagnostic tests that measure BAG3 would be indicated in the clinic.

CUSRR

Session ID:

P-39

Abstract Title:

Effects of Laromustine on Human Leukemic Cells

Presenting Author(s):

Jake Taylor ('14)

Other Authors:

Kevin P. Rice

Department:

Department of Chemistry, Colby College, Waterville, ME

Abstract:

Programmed cell death, or apoptosis, is a necessary phenomenon for human cells facing severe stress. Cancer cells are able to divide at an abnormally high rate by evading this suicidal defense mechanism. The research described herein seeks to measure a variety of cellular markers of apoptotic induction upon exposure to the anticancer drug Laromustine. Laromustine has been successfully tested against leukemia and brain cancer in clinical trials, yet its complete mechanism of action remains elusive. The effects of Laromustine on cultured human leukemia cells will be monitored using an antibody array. Antibodies are specialized molecules generated in the body that recognize foreign entities and bind to them with high affinity. We are using a commercially available product arraying 43 unique antibodies recognizing human proteins that reflect an apoptotic response. We will compare extracts from cells that have been exposed to Laromustine to those that have not. These data, in concert with previously obtained genetic evidence of apoptotic induction, will more thoroughly illuminate the molecular responses that correspond to Laromustine treatment. Furthermore, once specific proteins have been identified, we expect to carry out more focused experiments studying these potential cellular targets.

CUSRR

Session ID:

P-40

Abstract Title:

Circadian Rhythms: Cryptochrome Expression

Presenting Author(s):

Dan Totten ('14) and Ariel Oppong ('16)

Other Authors:

Devin Gibbs ('14), Abby Lebowitz ('15), Jarildy L. Javier ('16), Mayra Arroyo ('16), Jocelyn Thomas ('16), and Andrea Tilden

Department:

Department of Biology, Colby College, Waterville, ME

Abstract:

Circadian rhythms are endogenously driven cycles that operate on an approximately 24-hour clock and entrain organisms to their environments. For example, sleep-wake cycles can typically be prompted by light-dark stimuli. At the cellular level, circadian rhythms are driven by molecular processes of protein transcription, translation, and negative feedback. Many circadian rhythm proteins are phylogenetically conserved in organisms as diverse as bacteria and humans, and *Drosophila* is the most extensively studied and well-characterized system. Essentially nothing is known about the molecular mechanisms of circadian rhythms in crustaceans. With the very recent publication of the first complete crustacean genome in 2010 (the water flea *Daphnia pulex*), we now have access to the bioinformatic tools to explore these mechanisms.

The purpose of our research is to determine the location and patterns of expression of circadian rhythm proteins in a variety of crustaceans with diverse ecological profiles, for example freshwater versus marine, and aquatic versus intertidal. In this study we specifically focused on a protein called cryptochrome, which in other species is involved in "resetting" the daily clock. It allows organisms to sense changes in day length because it is the only circadian rhythm protein that is directly activated by light. Our goal is to determine the location and timing of cryptochrome production to gain a better understanding of the neural structures involved in crustacean circadian rhythms.

We are using immunohistochemistry with fluorescent labeling to localize cryptochrome expression to specific tissues, structures, and times of day. We are using whole-mount *Daphnia* and dissected neural tissues from *Uca* for cell culture and whole-tissue staining.

CUSRR

Session ID:

P-41

Abstract Title:

How Does a Blowtorch Relate to Sonogashira Coupling Chemistry?

Presenting Author(s): Tyler E. White ('14)

Other Authors: Jeffrey L. Katz and Nicholas P. Bizier

Department: Department of Chemistry, Colby College, Waterville, ME

Abstract:

The research done by the Katz chemistry lab has made great strides in Nucleophilic Aromatic Substitution (S_NAr) reactions and the subsequent formation of oxacalix[4]arenes through an insightful discovery regarding the nature of the acetylene group. Acetylene, the same fuel used for high-heat torches in welding, is physically a linear molecule comprised of two carbons attached by a high-energy triple bond, and linked to a single hydrogen atom at each end. Acetylenes have been shown to function as Electron Withdrawing Groups (EWG) that serve to activate fluorobenzenes for S_NAr. Acetylenes are highly relevant in organic synthesis, drug development, and many other scientific fronts due to the versatile reactivity of the triple bond.

My specific project has focused the placement of acetylenes onto aromatic rings through a process developed by the chemist of the same name: Sonogashira Cross-coupling (Figure 1). This process uses two catalytic metals, palladium and copper, in a basic solution to complete the installation of the acetylenes in an efficient and high-yielding manner.

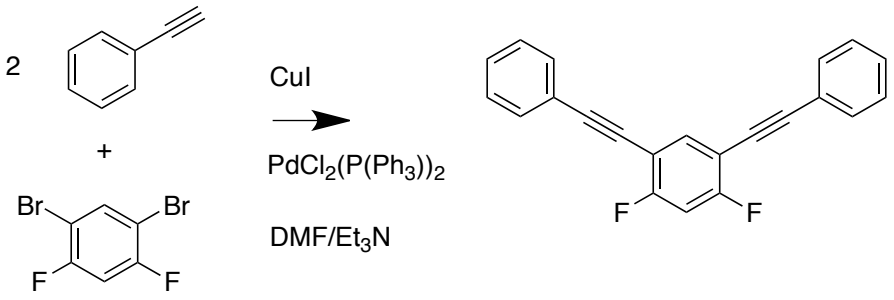


Figure 1

CUSRR

Session ID:

P-42

Abstract Title:

The Life and Scientific Achievements of Carl-Gustaf Rossby

Presenting Author(s): Alexa Williams ('15)

Other Authors: James Fleming

Department: Science, Technology, and Society Program, Colby College, Waterville, ME

Abstract:

Carl-Gustaf Rossby (1898-1957) was a significant meteorologist who helped transform weather forecasting and the academic field of meteorology. Despite his contributions, generally little is known about his life or work. There has never been a biography of Rossby's life and achievements, and Professor Fleming and I are working collaboratively with personal contacts and institutes that employed Rossby to find as much information as possible about this noteworthy meteorologist.

Rossby established meteorology departments at MIT, the University of Chicago, and the University of Stockholm. He was involved in the production of numerical weather forecasting with John von Neumann at Princeton and spearheaded a similar initiative in Sweden. Rossby's most notable contribution to the science of meteorology was the development of Rossby Waves, which are planetary-scale waves in the upper atmosphere that help steer and support the weather conditions at the surface. Rossby also had an interest in oceanography. He developed the joint MIT- Woods Hole Oceanographic Institute program in dynamics and invented an instrument called the oceanograph; the precursor to the bathythermograph which is used by researchers today to measure salinity, temperature, and pressure.

By working on this project, I have gained more knowledge about the history and science of meteorology and how Rossby's determination and scientific accomplishments fit into the advancement of this science. Research on this project will result in the publication of a book that will help people learn about the history of meteorology and the great meteorologist who aided in the growth of this field.

CUSRR

Session ID:

P-43

Abstract Title:

CPU Sim Redesign

Presenting Author(s):

Jinghui Yu ('15)

Other Authors:

Ben Borchard ('14), Stephen Morse ('14), and Dale Skrien

Department:

Department of Computer Science, Colby College, Waterville, ME

Abstract:

Computers are very widely used, but not as widely understood on the machine level. To assist students in learning the low level structures that exist within a CPU (Central Processing Unit--the "brains" of a computer), professor Dale Skrien created a program named CPUSim. This software allows users to develop and simulate their own CPU systems, writing and running low level machine and assembly language programs to complete simple tasks. Our project, this summer, has been to remake and improve the user interface for CPUSim using a software package known as JavaFX. This project has required us to think creatively, regularly determine what features the user would find most useful, and come up with new solutions to problems that arise from changing CPUSim to run using JavaFX. CPUSim is currently being used in a variety of different institutions around the world to help many people learn about computer architecture, and is even being translated to Chinese. In a world where Computer Science and technology are so prevalent, CPUSim stands out as a tool to help students learn the fundamentals of CPU processing. The many improvements and entirely new interface that result from this project will greatly improve the software.

CUSRR

Session ID:

P-44

Abstract Title:

Iodination of Chemicals to Produce New and More Efficient Electrophiles

Presenting Author(s):

Zhicheng Jacob Zhang ('16)

Other Authors:

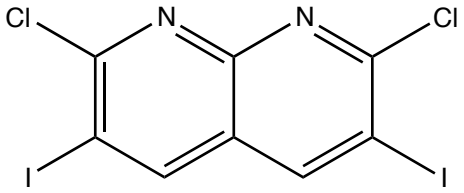
Jeffery L. Katz and Nicholas P. Bizier

Department:

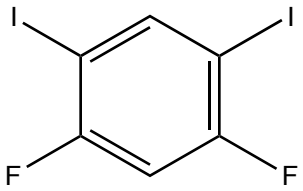
Department of Chemistry, Colby College, Waterville, ME

Abstract:

Oxacalix[4]arenes are formed from four aromatic rings bridged with oxygen, the heteroatoms. The syntheses of this sort of macrocycles have been the center of research in the Katz Group for years. The goal of this project is to increase the scope of the electrophiles for the formation of oxacalix[4]arenes. The naphthyridine 2,7-dichloro-3,6-diiodo-1,8-naphthyridine had been identified as a potential target, which had never been synthesized. The synthesis of the molecule started from iodinating 2,7-dihydroxy-1,8-naphthyridine. For the second and the last step of this synthesis, two chlorine atoms replaced the hydroxyl groups and the target 2,7-dichloro-3,6-diiodo-1,8-naphthyridine was formed and purified for future researches. For the next few weeks, the iodination methodology will be extended to iodinate 1,3-difluorobenzene, which will be available as another building block for other researchers in the near future.



2,7-dichloro-3,6-diiodo-1,8-naphthyridine



1,3-difluoro-4,6-diiodobenzene

CUSRR

Session ID:

P-45

Abstract Title:

Captive Conflict: The Consequences of Keeping Large Cats in Captivity

Presenting Author:

Zakary Jaques ('14)

Other Authors:

Noah Teachey ('13), Elizabeth Elliott ('16), Alexander Rutan, and Philip Nyhus[1]

Department:

Environmental Studies Program, Colby College, Waterville, ME

Abstract:

Large cats, such as tigers, lions, and cougars, are kept in captivity worldwide, where they are found in locations that range from zoos in Japan to apartments in New York City. Although zoos and captive breeding programs can serve as an important tool for species conservation and preserving genetic diversity, private ownership of these animals can have tragic consequences for owners, visitors, and the animals. We collected data on attacks by tigers, lions, cougars, leopards, servals, cheetahs, jaguars, bobcats, ligers, lynxes, caracals, panthers, wildcats, tigons, jungle cats, clouded leopards, and snow leopards, since 1997. Newspaper archives from the Boston Globe, Washington Post, Los Angeles Times, and New York Times were also searched for historical data for the years 1700 to 1980. We characterize the most attack-prone species, locations, circumstances, and age groups, as well as what activities and venues were most often involved in attacks. Tigers were involved in the most captive cat attacks and most fatal attacks, and that these attacks most often occur in the United States to children. Since 1998, there have been 459 documented large cat attacks worldwide, 55.2 percent of which occurred in the United States; 40 percent of attacks where age data was available, occurred to children under 10. Although attacks at zoos and similar conservation centers are often artifacts of maintaining these species, injuries and deaths under private ownership are often preventable with stricter laws and enforcement. By looking at associations between the location and frequency of attacks and legislation in those regions, we hope to be able to suggest policies that may decrease the frequency of large cat attacks.

The organizers of the 2013 Colby Undergraduate Summer Research Retreat would like to thank our generous sponsors.

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