Colorado State University – Pueblo

and the

College of Science and Mathematics

present their

11th Annual Science and Mathematics
Student Research Symposium

Thursday, October 22, 2015
Life Sciences Building

1:00 p.m. – Keynote Speaker
Dr. Paul J. Hurtado, Assistant Professor
University of Nevada, Reno
Life Sciences Auditorium

2:00 – 3:00 p.m. – Poster Presentation
Life Sciences Foyer

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_____= Presenter
*= Undergraduate Student
^= Graduate Student

Developing New Microwave Experiments for Undergraduate Organic Chemistry Lab

Aileen Ojeda * and Dr. David Dillon

Department of Chemistry

Research Project #1 – ABSTRACT

Through recent acquisition of an organic synthesis microwave system, our department now has the technology to incorporate state-of-the-art microwave methods into our undergraduate organic chemistry laboratory curriculum. This work focused on the evaluation of proposed new organic synthesis experiments using microwave technology for our labs. Specific experiments that were evaluated included a Diels-Alder reaction, alkaline hydrolysis of a nitrile, an intramolecular aldol condensation, and a Knoevenagel condensation. The aldol condensation is an intramolecular variation on a theme already incorporated into our lab curriculum. The nitrile hydrolysis and Knoevenagel reaction are new to our curriculum.

An Investigation of the Relative Migratory Aptitude of Phenyl and Substituted Phenyl Groups in the Baeyer-Villiger Reaction

Megan Bissell*, Jackie Killen*, Beth Withrow* and Dr. David Dillon

Department of Chemistry

Research Project #2 – ABSTRACT

The Baeyer-Villiger reaction (B-V) is an important reaction for synthesis of esters with biomedical and industrial applications from ketones. The reaction uses a peracid (peroxy acid), similar to hydrogen peroxide, to insert an oxygen between the ketone carbonyl carbon (C=O) and an α carbon (adjacent to the carbonyl). The insertion involves an initial attack by the nucleophilic peroxy oxygen group followed by migration of a carbon group. The B-V reaction has been studied both experimentally and computationally in order to better understand the mechanism by which the ester products are formed. It is well-established that highly substituted carbons (tertiary carbons) migrate better than less substituted carbons (secondary or primary), but the migration of the chemically important phenyl type carbon is less well understood. This project focuses on B-V reactions of variously substituted phenyl ketones and phenyl aldehydes in order to compare migratory aptitude of different kinds of phenyl groups with hydrogen and various kinds of alkyl carbons.

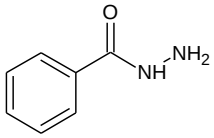
Synthesis and Antimicrobial Activity of Benzohydrazides Substituted at the aryl and N' Positions

Alisha Mason*, Sarah Thompson*, Dr. Daniel Caprioglio, Dr. Jordan Steel and Dr. David Dillon

Department of Chemistry

Research Project #3 – ABSTRACT

Benzohydrazides have the general formula, 1. Benzohydrazides substituted at the aryl and N', 2, have previously been shown to have antibacterial and antifungal properties and are also suggested to have antimicrobial and antitumor activity. This class of antibiotics is hypothesized to bind to DNA giving the antibiotic properties. Their antimicrobial effectiveness can be tuned by adjustment of the substituent groups. This work describes the synthesis and antimicrobial evaluation of several aryl and N' substituted benzohydrazides in a multidisciplinary approach involving organic synthesis and microbiological studies. Synthesis of 2a and 2b has been completed in the organic chemistry lab, and antimicrobial activity has been evaluated using the Kirby-Bauer antibiotic susceptibility method in the microbiology lab. Preliminary results have shown antimicrobial activity against Gram negative bacillus, *Escherichia coli*, and Gram positive bacillus *Bacillius megaterium*.



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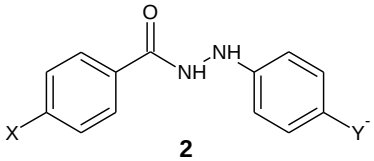

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2a: X = NO_2; Y = H

2b: X, Y = NO_2

The Presence of *Protostrongylus stilesi* in Rocky Mountain Goats and the Effects of Infestation

Christa Dunlap* and Dr. Brian Vanden Heuvel

Department of Biology

Research Project #4 – ABSTRACT

The lungworm, *Protostrongylus stilesi*, is a nematode that burrows into the lungs of large animals, particularly ungulates, thus creating an ideal habitat for the pneumonia-causing bacteria, *Pasteurella haemolytica*. Effects of *Protostrongylus stilesi* have been accounted for in bighorn sheep herds throughout much of North America, but their presence in Rocky Mountain goats has yet to be tested. In order to investigate the effects of lungworms on the mountain goats, DNA extractions from fecal matter were executed. Polymerase chain reaction and gel electrophoresis was then performed on the isolated DNA. It was hypothesized that Rocky Mountain goat herds, in Colorado, currently contain heavy lungworm parasite loads given their immense similarities to bighorn sheep, thus leading to herd declination. Although a few aspects regarding the results are still being conducted, the findings reveal that the goat fecal samples taken from various Colorado locations including, Mount Evans, Cottonwood Pass, and Lake Deluge do contain DNA associated with an unidentified, non-goat source. Specific primers tailored for *Protostrongylus stilesi* were utilized in order to investigate if the DNA belongs to lungworms. Prominent DNA bands were revealed after polymerase chain reactions and gel electrophoresis was conducted on the lungworm specific concoction. In order to ensure the DNA bands belong to *Protostrongylus stilesi* the DNA was extracted from the gel, purified, and sent off for sequencing. In the event that there is affirmative confirmation of lungworm infestation in the Rocky Mountain goat herds mentioned, de-worming protocols will be implemented in association with the Colorado Division of Wildlife.

Do LEEDS Buildings Represent an Increased Risk to Migrating Birds?

Elizabeth Smith* and Dr. Claire Ramos

Department of Biology

Research Project #5 – ABSTRACT

Bird-window collisions are a topic of conservation concern with so many birds living in urban habitats, in contact with human-structures, and navigating through these environments during the spring and fall migrations. Buildings those that use large amounts of windows seem to be the most dangerous for Passerine birds. Many of these buildings are Leadership in Energy & Environmental Design's-certified (LEEDS) environmentally-friendly buildings. The amount of bird-window collisions that occur at large areas of window-surface call into question whether these buildings can be truly labeled as 'green' when they impact the resident and migratory birds. The Colorado State University-Pueblo campus is located along the Central Flyway which extends from Canada, along the Rocky Mountain range, into Mexico. This flyway is used by migrating species during the spring and fall migrations. The impact of LEEDS-certified projects and renovations could be related to the many bird-collisions occuring on the CSU-Pueblo campus. Walking surveys were conducted every day in fall of 2015 and carcasses were collected at buildings on campus, three LEEDS-certified and three non LEEDS-certified. Results will be discussed.

Is Mercury Bioaccumulation Related to Age in Passerine Birds?

Carley Knutsen* and Dr. Claire Ramos

Department of Biology

Research Project #6 – ABSTRACT

Mercury is a global pollutant and known endocrine disrupter that bioaccumulates up the food chain. Studies have established that in birds mercury lowers immune system function, increases oxidative stress, alters behavior, and reduces reproductive stress. The negative effects of mercury make it a conservation concern for maintaining healthy bird populations. Substantial variation in mercury bioaccumulation has been found among bird species, though this variation has yet to be fully explained. Mercury bioaccumulation has been shown to increase with age in species of seabirds; however, it is uncertain if terrestrial passerine birds accumulate higher mercury concentrations with age. We examined the relationship between mercury bioaccumulation and age in passerine birds. This study uses data from birds captured multiple times along Fountain Creek, Colorado to detect annual changes in blood mercury between 2014 and 2015. Results will be discussed.

Reactions of 3,6-bis(2-pyridyl)-1,2,4,5-tetrazine and metal(II) chlorides

Jillian Mannikoff*, Dr. David Dillon, Dr. Melvin Druelinger and Dr. Matthew Cranswick

Department of Chemistry

Research Project #7 – ABSTRACT

Inorganic chemistry is the branch of chemistry that focuses on the synthesis and behavior of inorganic molecules and organometallic compounds. In collaboration with Drs. Mel Druelinger and David Dillon of the Chemistry Department we are investigating the formation of metal complexes in which at least one ligand is derived from 3,6-bis(2-pyridyl)-1,2,4,5-tetrazine (bptz). Our initial studies have focused on reacting first-row transition metal(II) chlorides (MCl_2) with bptz in acetonitrile in a 1:1 and 2:1 MCl_2:bptz ratio. The reactions of $FeCl_2 \cdot 4H_2O$ and anhydrous $MnCl_2$ with bptz have been investigated. These reactions yielded very different colored solutions, dark blue and plum, respectively. The initial characterization of the crude solids isolated from these reactions will be presented.

Comparing Mercury Levels in Blood and Feathers in Migratory and Resident Birds in the Fountain Creek Watershed

Alyssa Torres*, Carley Knutsen^ and Dr. Claire Ramos

Department of Biology

Research Project #8 – ABSTRACT

Mercury is a potent neurotoxin and is a great danger in the environment. Mercury pollution is caused by coal-fired power plants and other industrial processes. Mercury pollution can have strong effects on song including changes in behavior and songs. Mercury levels in songbirds can be tested non-lethally using breast feathers, tail feathers, and blood. Sampling from feathers can be less invasive than sampling from blood, but it is unclear how well feather mercury reflects blood mercury. Feather mercury is a measure of the mercury burden at the time that the feather was grown. Because most migratory birds grow their feathers on the wintering grounds, their feather mercury levels may not reflect blood mercury levels collected on the breeding grounds. Thus feather mercury may correlate better with blood mercury in resident species. We analyzed blood and feather mercury from birds captured along Fountain Creek using a direct mercury analyzer. Results will be discussed.

Are Mountain Goats At Risk For Biomagnification? Mercury Concentration in Rocky Mountain Goats and Their Potential Food Sources

Jeanette Cortez ^, Chris Cincotta * and Dr. Claire Ramos

Department of Biology

Research Project #9 – ABSTRACT

Rocky Mountain Goats are the least studied large mammal in North America. Little is known about their overall health and behavior, including foraging behavior. A potential health risk is high levels of mercury concentration due to elevated deposition in western states and high absorption rates of mercury in potential food sources. A better understanding of their foraging habits are needed to determine if these animals are at risk of biomagnification. This would provide insight to possible future declines in populations causing a need for conservation efforts. We investigated the level of total mercury (THg) concentration in mountain goats through non-invasive collection of hair from Mount Evans, a high altitude location in Colorado. In addition, moss and lichen material, currently assumed to be an important food source for mountain goats, was collected to test for THg concentration. Preliminary results show a low level of THg in hair samples tested (< 27ppb), which may indicate Hg accumulation may not be a concern in mountain goats. However, preliminary results of lichen concentrations were found to be much greater than what was found in the goat hair, ranging from 90ppb-400ppb. This may indicate the goats either are not relying on this food source, or they are not accumulating mercury from the lichen. Preliminary results on moss concentration will be discussed. Further testing of lichen and mosses collected will also be compared to plant and lichen DNA extracted from fecal matter to which may indicate whether or not this material is actually a food source for mountain goats.