BioMass

Biology Student Newsletter

February 2016

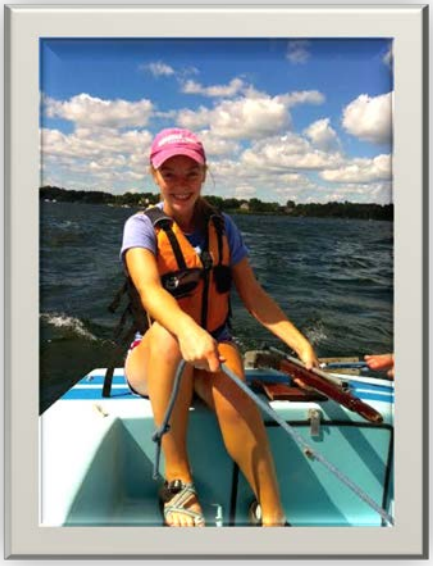
BIOMASS COORDINATOR: KIRSTEN SLETTEN '16

Senior Reflection: Amelia Schurke

by Amelia Schurke, '16

Daily life at St. Olaf is crazy busy. Ask any Professor, student, or passerby. In my time at St. Olaf, I've gone from being frantically swept-up by the chaos as a freshman, to finding a balanced rhythm amidst the commotion as a senior. I've learned so much during my journey here, both in and out of the classroom. I have come to deeply cherish opportunities to slow down, reorient myself and appreciate my surroundings, directing my attention not to the constant mental mapping of schedules and walking-routes, but to the moment, the people I'm with and the many things in my life to be thankful for.

Studying Biology at St. Olaf has provided me with great insight on how to truly appreciate my surroundings, as I've learned about the processes and mechanisms that keep our bodies and our world functioning. Microbiology opened my eyes to understanding the role of the many bacteria that coexist with us in our world. Genetics gave me a renewed appreciation for the complexity of our bodies and the incredible machine the human body is. Biology of Reproduction reaffirmed what a privilege it is to even be living, providing me with an understanding of all of the obstacles we (in our very beginnings) had to overcome to exist in the world we do today as developed and thriving individuals.



I have absolutely loved studying Biology at St. Olaf. For me, gaining exposure to the many different fields of Biology has provided me with numerous and complex ways to appreciate my life. Gaining awareness and appreciation of the incredible processes and interactions that are occurring in and around me on micro and macroscopic levels everyday has been a wonderful journey that has reaffirmed my belief that there is always something to be thankful for!

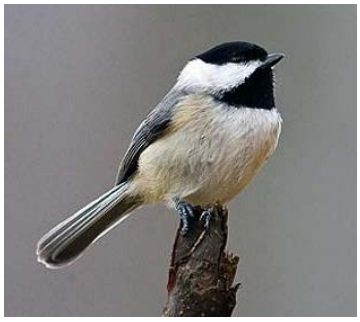
IN THIS ISSUE:

Student Naturalist Article:

Winter Birds on the Hill

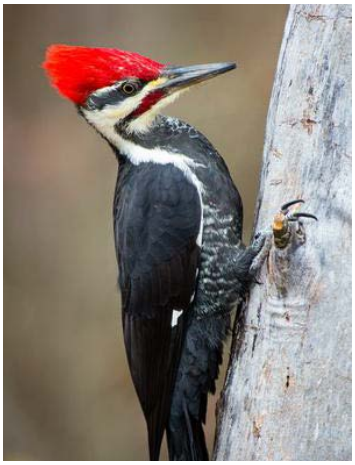
by Emilee Martell, '17

It takes a fearless bird indeed to brave a Minnesota winter. While many species bask in tropical warmth, a few diehard avians choose instead to stay up north and hunt for seeds in thirty-below wind-chill. Here is a tribute to some of the birds that choose to stick around the Hill during the cold months.



Black-capped chickadee (*Poecile atricapillus*)

Conservationist Aldo Leopold affectionately described the black-capped chickadee as a "small bundle of large enthusiasms." As anyone with a bird feeder in the upper half of North America has observed, chickadees are energetic, entertaining birds. A flock of chickadees is known as a "banditry"—a reference to their black mask or cap. Out in the natural lands, keep an ear out for their distinctive "chick-a-dee" call. As you approach, this call may go from one "dee" to a long line of them—the more notes there are, the greater the level of alarm.

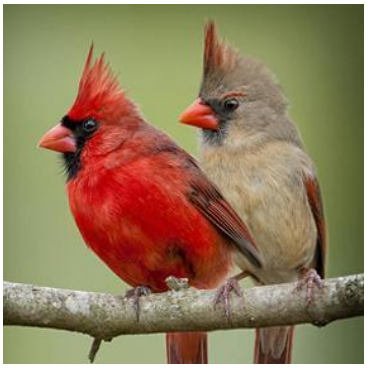


Pileated woodpecker (*Druocopus pileatus*)

There are three species of woodpeckers that you are likely to observe on campus: downy, red-bellied, and pileated. The downy woodpecker is the smallest, barely larger than a chickadee, with a checkered black-and-white back. Males have a red patch on their heads. The red-bellied woodpecker is larger, about the size of a robin. "Red-bellied" is a misnomer; these birds have tan bellies, barred backs, and a red cap (they are not called "red-headed" because another, much rarer woodpecker claimed that title first). The pileated woodpecker, with a black body, white markings, and a bold scarlet crest, is far showier than its smaller cousins. These birds are nearly as big as crows and can be heard loudly hammering away in Norway Valley. All three woodpeckers can be distinguished by their bouncing flight, which consists of several wing beats followed by a short dive, rather than the steady flapping seen by other birds.

During this time of year, bright red male cardinals are the flashiest birds around, though the brown-gray female is also very stylish. Both sexes are enthusiastic singers; listen for strings of whistles ending in a trill. Cardinals spend the winter peacefully looking for seeds, but come spring, these birds get so aggressive about defending their territory that they will fight their own reflection for hours. Strange as this behavior seems, it has not reduced the popularity of the cardinal; it is the official bird of seven states.

Many other species—juncos, nuthatches, goldfinches, etc—also make Minnesota their home during the winter. Keep an eye out during your next trek in the natural lands—you'll be amazed by the variety (and tenacity) of our winter birds.



Red cardinal (*Cardinalis cardinalis*)

Sources:
http://www.birdorable.com/blog/fun-facts-about-chickadees/
http://birding.about.com/od/birdprofiles/a/15-Fun-Facts-About-Woodpeckers.htm
https://www.allaboutbirds.org/guide/Northern_Cardinal/lifehistory
https://www.allaboutbirds.org/guide/PHOTO/LARGE/carolina_chickadee_2.jpg
http://www.ericpreston.com/img/s4/v62/p1249575432-3.jpg
http://birdnote.org/show/voices-and-vocabularies-cardinals-duet

Summer 2016:

Undergraduate Research Opportunities on the Hill

by Kirsten Sletten, '16

Impact of Maternal Prenatal Stress on Growth of the Offspring **with Professor Sarah Amugongo**

Unperturbed fetal development is essential for the future health of an individual. The goal of this project will be to test the effect of maternal prenatal stress on bone development using rats as animal models in the laboratory. Histological techniques will be used to assess bone development. The ideal candidate should have a string interest in Physiology. Desired skills are histology and histomorphometry.

Prairie Restoration **with Professor Diane Angell**

This summer we will focus on two projects both related to prairie restoration. Our first project will focus on experimenting with methods to increase plant community diversity in restored prairies. We will also continue to assess bumblebee diversity on prairies. Both these research projects will inform conservation efforts by various agencies and institutions as they enact incentives to maintain and restore habitat in Minnesota.

Tetrahymena Proteomics **with Professor Douglas Beussman**

This project includes collaborating with Dr. Cole in the Biology Department, as well as research groups at Drake University in Iowa, Claremont Colleges in California and Missouri State University, on the identification of proteins isolated from*Tetrahymena thermophila*, using state-of-the-art proteomic methods. Students with an interest in bioanalytical, analytical, pharmaceutical, or medical research are encouraged to apply.

Scavengers! How Starving bacteria take up scarce nutrients **with Professor Lisa Bowers**

This project will focus on a class of transport molecules (TonB Dependent Receptors) and their role in nutrient acquisition. *Caulobacter crescentus*, an aquatic bacterium, has an unusually high number of these receptors and my lab is interested in what molecules they are transporting, what impact they have on the fitness of the cell, and when they are expressed. Students will use genetic, molecular, biochemical, and bioinformatics techniques to answer these questions. Students should have completed Genetics before summer research.

Fast Evaluation of Caulobacter in response to predation by a ciliate predator **with Professors Lisa Bowers and Eric Cole**

Bacteria reproduce every two hours. Under optimal conditions, mutations will arise in every possible DNA base pair within two weeks of unrestricted growth. Hence, they can potentially evolve very fast. We wish to test the ability of the freshwater bacterium *Caulobacter crescentus*, to evolve predator avoidance in a short period of time, by growing them in the presence of *Tetrahymena thermophila*, a ciliate predator. This project involves sterile cell culture technique, bacteria culture and microscopy.

Functional traits, genetic correlations and adaptive evolution of purple coneflower populations in prairie remnants of MN **with Professor Alyson Center**

Students will participate in the collection of physiological measurements on plants from an experiment designed to examine genetic components of variance in fitness and other traits. Students will measure maximum photosynthetic rate, stomatal conductance, intrinsic water-use efficacy, specific leaf area and other traits on different aged plants that vary in their degree of relatedness. Students will also explore fundamental concepts in quantitative genetics and contribute data analysis to examine components of phenotypic variance and genetic correlations among traits. Preference will be given to students who have had BIO 261 and have some experience in statistics.

Ciliate Conjugation **with Professor Eric Cole**

We will be exploring two questions:
What proteins constitute the cell-cell junction that forms between mating *Tetrahymena* cells?
And what is the signaling role that calcium ions play in preparing cells for mating

> "Research is formalized curiosity. It is poking and prying with a purpose."
> - Zora Neale Hurston

Retinal Circuits **with Professor Jay Demas**

My lab studies the neural circuits that process sensory information. In particular, we focus on retinal ganglion cells (RGCs), the output neurons of the vertebrate retina that communicate with the brain. This summer we will examine the role of inhibition onto ipRGCs by comparing mice that are genetically engineered to eliminate specifically this connection in the circuitry of the retina to wildtype control mice.

Tolerance to ethanol and caffeine in mice **with Professor Shelly Dickinson**

The research will investigate the impact of caffeine exposure on the effects of alcohol in mice, using one or more behavioral assays, including place conditioning, taste conditioning and/or locomotor activity. Place and taste conditioning will be used to determine whether caffeine exposure, alters the motivational properties of alcohol. Locomotor activity studies to assay the development of tolerance and sensitization. Some of these basic questions are being addressed by student research this spring, so the summer project(s) will expand on these findings.

Computer Simulation of sex Ration Evolution **with Professor Steve Freedberg**

This project utilizes individual-based computer simulation models to explore the evolution of sex ratios in natural populations. The student researcher will work to develop programs that explore how population-level processes contribute to the success and persistence of female-biased populations in a range of species. Programming experience is required.

SUMOylation in *Tetrahymena* **with Professor Kim Kandl**

Current work in my lab focuses on SUMOylation and mitochondrial morphology in *Tetrahymena thermophila*. This summer we will work to test hypotheses about what role SUMOylation plays in mitochondrial morphology, and we will perform assays to examine mitochondrial function in *Tetrahymena* with altered SUMOylation patterns. We will also design experiments to identify the SUMOylated mitochondrial proteins in *Tetrahymena*.

Auditory Cognitive Ability, Perceptual Learning and Cochlear Implants **with Professor Jeremy Loebach**

Cochlear implantation has proven to be a successful treatment for profound hearing loss in individuals who do not receive a benefit from hearing aids. CI recipients differ substantially in speech perception abilities before implantation. It is possible that CI users develop different sets of neurocognitive skills along the way, which may contribute to these differences. We began testing this possibility in the summer of 2015. The goal of this summer research project is to continue investigating the neurocognitive skills in CI users, and track how they develop over time in new cochlear implant users that are undergoing our training program.

Milkweed Adaptations in a Changing World **with Professor Emily Mohl**

This research project aims to investigate a number of questions about adaptations of Common Milkweed. The project, based at St. Olaf, depends upon collaboration with researchers and their students at other institutions. The main questions we will investigate are: Is there a geographic gradient in milkweed tolerance to herbivory? Are milkweed populations locally adapted to their region or habitat type, or there are certain superior milkweed genotypes that perform better in all locations? Students will use milkweed seeds collected from multiple sites in North America to begin to address these questions in both greenhouse and field settings. Students should have completed Bio150; backgrounds in statistics or education are valued.

Generating a "Sense of Direction" in the Brain **with Professor Gary Muir**

My research program is guided primarily by questions about the neural mechanisms of spatial cognition and navigation. The firing activity of individual neurons that encode the animal's directional heading – "head direction" cells – is thought to represent the animal's perceived "sense of direction," or orientation, which is critical for the animal's ability to navigate through its environment. But how is this directional signal generated and maintained in the brain? To answer these questions, students will have the opportunity to observe a "behaving" brain in action by recording the activity of single neurons while freely-moving rats perform spatial tasks.

Effect of genetics on reward learning and generalization of associations in aging **with Professor Jessica Petok**

This summers' project will examine the effects of aging on reward-based associative learning and generalization. Further, we will examine how these relationships vary by common genetic polymorphisms, exploring whether genetics can contribute to variability in cognitive function across the adult lifespan. Students will be trained to test college-aged, middle-aged and older adults, and will learn more about how age and genotype can contribute to our cognitive phenotype.

Cosolute Interactions with Nucleic Acids **with Professor Jeff Schwinefus**

For several years my research group has quantified the interaction of neutral organic molecules like urea or amino acids (which we generically call cosolutes) with the surface area of nucleic acids. This summer, we plan to probe the stability of biologically relevant nucleic acid structures such as G-quartet structures in DNA with urea, glycine betaine, and proline. We also plan to quantify the interactions of trimethylamine formate with nucleobases and related compounds to develop new probes of nucleic acid surface areas.

Effects of Agriculture and Habitat Restoration on Soil Health and Plant Productivity **with Professor Kathleen Shea**

Students working with me will examine the effects of cover crops and tillage patterns on corn and soybean agriculture with the goal of determining how to maintain healthy soil on the St. Olaf agricultural lands. Students will conduct research on working farms with the opportunity to help farmers make appropriate decisions about sustainable farming practices. Research will build on previous studies and examine changes in soil chemical and physical characteristics over time. We will compare different cover crop methods and their effects on variation in soil properties, germination and growth of crops and weeds, field runoff, and crop yields.

HOW TO APPLY:

Applications due **Friday, February 19**

Learn More About the Programs: http://wp.stolaf.edu/curi/2016-summer-undergraduate-research-projects/

Apply Online Today: http://wp.stolaf.edu/curi/summer-undergraduate-research/