

# 10<sup>TH</sup> ANNUAL NORTH PARK UNIVERSITY UNDERGRADUATE RESEARCH SYMPOSIUM

THURSDAY, MAY 5, 2016

BRANDEL LIBRARY, NORTH PARK UNIVERSITY

CHICAGO, ILLINOIS

## PROGRAM

Event	Time	2 <sup>nd</sup> Floor Gallery
Welcome	3:30 pm	Professor Yoojin Choi
Student Presentations	3:35 pm 3:50 pm 4:05 pm 4:20 pm	Saul Lopez (Biology) Elwin Clutter (Chemistry) Juliana Spricigo (Nursing) Jessica Hale (Biology)
<b>Refreshments</b> 4:20-4:30 pm		
Student Presentations	4:30 pm 4:45 pm  5:00 pm 5:15 pm	Sladana Nikezic (Biology) Gracie Williams and Lucia Tejada (Biology) Emily Mordan (Chemistry) Rebecca DeKorne (Psychology)
Closing Remarks	5:30 pm	Professor Yoojin Choi

*Following the symposium:* Discussion and dinner (served at 6:30pm) for presenters and faculty advisors at the Hawkinson House: 5258 N. Spaulding Avenue.

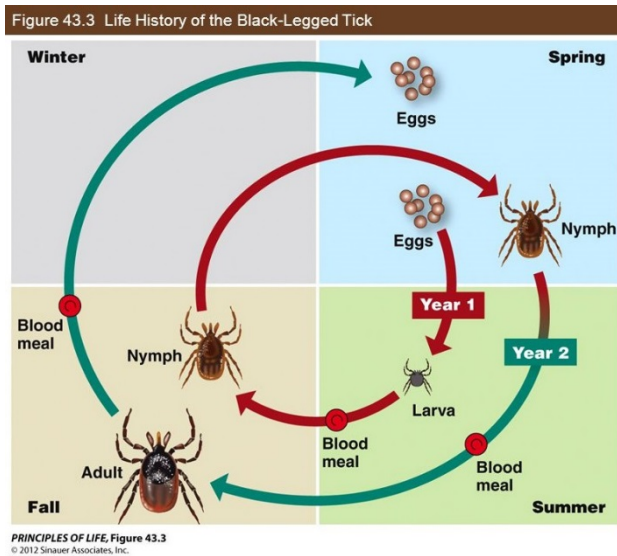
## ACKNOWLEDGMENTS

We wish to thank the students and faculty mentors for their efforts at creating original works of knowledge. This year's Undergraduate Research Committee consisted of Profs. Ilsup Ahn, Yoojin Choi, Margaret Kotowski, Ter-Yun Lin, Jon Rienstra-Kiracofe, Rachel Schmale, and Sarah Thorngate. Special thanks to Provost Emerson and President Parkyn for their support and for underwriting the cost of the symposium.

## Screening the Chicagoland Area for *Borrelia miyamotoi*

Saul Lopez  
Dr. Matthew Schau, Dr. Drew Rholl  
Biology Department

*Borrelia burgdorferi sensu stricto* is the causative agent of Lyme disease and its presence is well established in the Chicagoland area (Jobe). Lyme disease is an infection that comes with myalgia, fever, fatigue, and sometimes a bull's-eye rash. A related organism, *Borrelia miyamotoi*, has been linked to cases of relapsing fever in Japan, Russia, Eurasia, and North America (Johnson). Relapsing fever is commonly accompanied by chills, nausea, and vomiting that reoccurs every three to five weeks. The symptomatic similarities between the two bacteria make them difficult to distinguish unless molecular diagnostic tests are carried out. With *B. miyamotoi* infection increasing, it is important to be able to identify and test for the bacterium. To date, little work has been done to survey the Chicagoland area for the prevalence of this newly emerging pathogen.



*B. miyamotoi* is transferred to humans via several species of *Ixodes* ticks. The endemic vector for *B. miyamotoi* in the Chicagoland area is *Ixodes scapularis*, the blacklegged deer tick. The focus of this work was to screen ticks collected from the area through the use of molecular analysis such as Polymerase chain reaction, or PCR, a commonly used method for detecting DNA sequences in environmental samples. In our study, we used *B. miyamotoi* specific primers to amplify and detect the *glpQ* gene, which codes for Glycerophosphodiester Phosphodiesterase, in order for us to differentiate *B. miyamotoi* from other species of *Borrelia* found in the area.

Over the past year, 55 tick pools, totaling 275 individual ticks, have been screened for *B. miyamotoi*. No positive results have been detected in the screened samples. Common issues with PCR include non-specific binding of the primers to the template DNA, potentially rendering false-negative results. Multiple primer sets have been adopted in order to determine the most sensitive assay. Future work includes additional screening in order to determine whether the lack of detection has been caused by technical issues or if *B. miyamotoi* has yet to become established in this area.

### Sources

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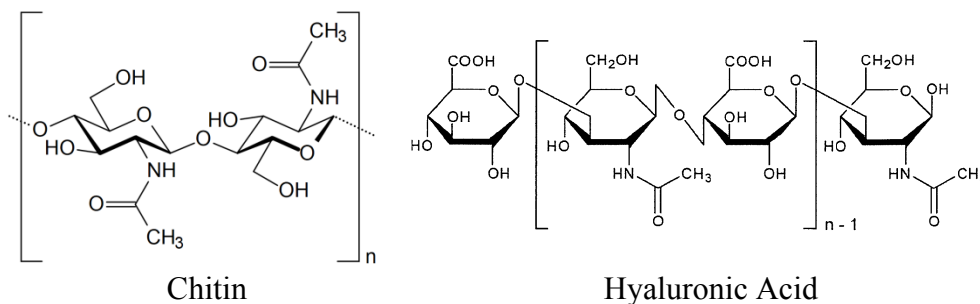
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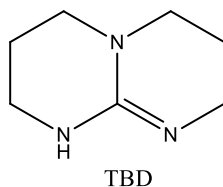
## Efficient Guanidine-Catalyzed Amidation of Alkyl Acetates

Elwin D. Clutter II  
Dr. Isabel Larraza  
Chemistry Department

Acetamides have several uses within organic chemistry. This ubiquitous functional group can be found in many natural products, such as chitin in exoskeletons of insects and pharmaceuticals, such as hyaluronic acid used as joint lubricants, as well as during eye surgery.



Formation of acetamides from primary and secondary amines tends to utilize materials such as pyridine and acetic anhydride, which the former is undesirable due to its mutagenic and carcinogenic nature. In addition, high temperatures and long reaction times are needed to allow this process to occur with less reactive amines. Our method replaces acetic anhydride with ethyl acetate, which serves as both a reactant and a solvent. Small amounts of 1,5,7-triazabicyclo[4.4.0]dec-5-ene, TBD, are used as a superbases<sup>2</sup> which helps to increase the reaction rate along with the use of microwave-assistance.



We performed a systematic study of aliphatic and aromatic amines, in order to find the optimal conditions of temperature, reaction time and amount of reactants. We found that with TBD we could effect successful reactions with as low as 5% molar equivalent, increasing the atom efficiency of the reaction. These conditions have improved the overall reaction by decreasing reaction times, which resulted in less energy consumption, as well as a devising a method that requires little to no undesirable chemicals. It demonstrates effectiveness under much greener (i.e. safer and more environmentally friendly) conditions than the conventional methods.

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## **Educational Tool for Transition Care**

Juliana Spricigo  
Dr. Dimitra A. Loukissa  
Nursing

Healthcare professionals agree that treatment alternatives should be analyzed and chosen in partnership with patients however, “end of life options” discussions do not regularly take place. Lack of conversation ultimately leads to patient’s lack of knowledge, and mismatch between personal preferences and care delivered (Trafford Crump & Llewellyn-Thomas, 2013). Literature review shows that lack of time, training, and level of confidence approaching the topic are among the factors that hinder end of life discussions by healthcare professionals (Jeong, Higgins & McMillan, 2010).

This project aimed to create an educational tool presenting end of life treatment options and other relevant information in an accessible format to patients and their families. The tool will be utilized as an instrument to surpass healthcare professionals’ discomfort, leading to an earlier discussion.

The transitional care team of a local hospital identified that the majority of the readmitted population were patients diagnosed with end stage chronic conditions or terminal illnesses, who could benefit from “end of life options” discussions. The project was developed to help decrease readmission rates of these patients within thirty days of discharge. The preceptor acknowledged that discussions did not occur earlier during hospital stay or routine appointments. Social services, and palliative nurse were notified, and requested to get involved only after readmission. Despite the fact that only twenty-four percent of the twenty-five anonymously surveyed staff declared discomfort initiating dialogue, chart review showed that seventy-five percent of patients were not offered palliative consults, nor were engaged in “end of life” discussions.

The project encompassed the creation of a brochure, considering staff’s input, Illinois Legislation, and literature. The brochure was introduced to nurses on April nineteenth. Anonymous questionnaires measuring nurse’s knowledge and comfort levels regarding the topic were administered after brochure presentation. Additionally, retrospective chart audit was done, to gather anonymous percentages regarding discussion rates, ethics history assessment, and filing of Advance Directives.

The Kurt Lewin Model of Change (1947) was utilized to guide the process, due to the possibility of linear implementation, and minimal time and staff training requirements. According to this model, change occurs within three sequential stages: unfreezing (recognizing the need for change), experiencing the change, and refreezing (incorporating the change) (Yoder-Wise, 2014). Since the organization was experiencing the unfreezing stage, the team was confident on its acceptance and adoption. The brochure has been initially distributed to one unit as a pilot program, so that readmission rates can be compared with those prior to its implementation. After data collection and evaluation, a decision will be made regarding its permanent implementation, further development, or creation of another method that can address the problem more effectively.

The success of the project can help the organization achieve its desired goals, and allow patients to receive appropriate care that meets their needs. The brochure can increase patients' awareness, and promote knowledge, facilitating transition through the process of death and dying. Open communication can not only enhance patient and family satisfaction, but also decrease healthcare costs and readmission rates (Wittenberg-Lyles, Goldsmith & Ragan, 2011).

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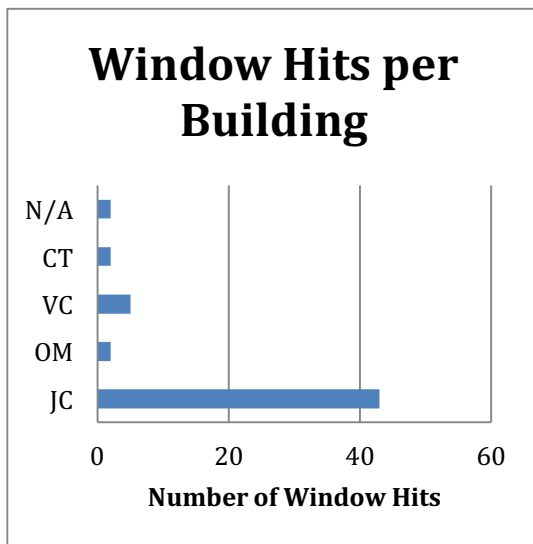


# The Relationship between Window Collisions and Blinds on Fall Migratory Birds over North Park University

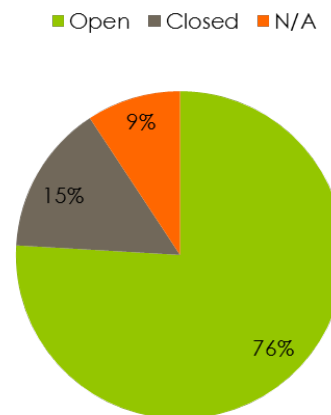
Jessica Hale  
Dr. Linda Vick  
Biology

Every year during the fall birds from Canada and the Northern parts of the United States make their journey south flying through areas which are not as familiar to them and may encounter various obstacles. These birds' innate behavior is to follow the location of the sun and landmarks along their journey (WMBD, 2007). However the obstacles they encounter, such as buildings with windows, prove dangerous on their journey. Two main reasons why birds fly into windows, as outlined by Patricia Leonard of the Cornell Lab of Ornithology, are because the birds either see straight through the glass if there is habitat directly behind it, such as in a glass walkway, or because there is a mirror reflection off of the glass displaying the habitat behind them and giving the illusion that the flying space continues (Leonard, 2013).

In this study the migratory birds flying the Chicago migratory flyway which collided with buildings flying specifically over North Park University were tracked. The purpose of this study was quantify the high occurrence of collisions with the addition of the new Johnson Center building and track if there was a correlation of collisions with the new building. Birds on the ground (injured or dead) were recorded in the mornings, due to their sun-compass behavior of having to follow the sun during either sunrise or sunset, from mid-August to mid-October. Their location, species, size and status of the building blinds at the location found were recorded. The data was analyzed using a 2-PropZTest to determine if more bird collisions occurred when the



### Window Collisions Related to Blinds Status



blinds were open versus when the blinds were closed.

It was found that there were a significantly more bird collisions when the blinds were open versus when the blinds were closed. Also, the Johnson Center was found to be the prime culprit involved in collisions. These results provide concern over the impact that the Johnson Center is having on biodiversity but also hope that we may fix the issue at hand. This data can be used to further test how manipulating the blinds can have an effect on the number of collisions and eventually lead to a higher LEED status of the Johnson Center by improving its impact on biodiversity.

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Locating the Gene(s) in *Burkholderia ubonensis* Responsible for the Antagonistic Activity  
Against *Burkholderia pseudomallei*

Sladana Nikezic  
Drew Rholl and Matthew Schau  
Biology

Melioidosis is an infectious disease whose signs and symptoms are similar to that of other respiratory infections, making diagnosis difficult. The disease is endemic in low income, tropical regions. It has a high morbidity and mortality rate due to its ambiguous presentation, lack of knowledge, and poor laboratory facilities (Currie *et al*, 2000; Inglis *et al*, 2001). The causative agent of melioidosis is *Burkholderia pseudomallei*. *B. pseudomallei* can be found in contaminated water and soil and is most commonly spread by direct contact with the contaminated source (CDC, 2012). Additionally, only a low dose is required to produce these high morbidity and mortality rates. As a result of *B. pseudomallei*'s low infectious dose, high antibiotic resistance and high mortality rate, it has been classified as a category B bioweapon. This heightens the need for research, but creates challenges for studying it in the lab. Alternative ways of research under more flexible conditions involve the usage of a low-virulent surrogate, *Burkholderia thailandensis*.

Prior research has shown that *Burkholderia ubonensis* produces an antagonistic compound against *B. pseudomallei*, although the exact molecule has not been identified. This antagonistic behavior by *B. ubonensis* against *B. pseudomallei* has great implications in the microecology and biocontrol of *B. pseudomallei* (Marshall *et al*, 2010). The purpose of our work is to identify the gene(s) responsible for the potentially novel antibiotic compound in *B. ubonensis*.

To manipulate the genome of *B. ubonensis*, we utilized the molecular techniques of transposon mutagenesis and gene knock-out via homologous recombination. Through these methods, the location of the gene(s) responsible for producing the antibiotic compound may be identified. In transposon mutagenesis, *E.coli* DH5 $\alpha$ ( $\lambda$ pir) containing pLG99 was mated with *B. ubonensis* A20 on LB agar. pLG99 contains a transposable element with a trimethoprim resistant gene. The transposon inserted itself randomly into the *Burkholderia* genome to inactivate genes. Then the conjugants were plated on LB Tmp to select for resistant *Burkholderia*. During transposon rescue, the *B. ubonensis* genomic DNA of interest from an antibiosis assay were extracted and digested with *NotI*. It was then ligated with T4 DNA ligase and electroporated in competent DH5 $\alpha$ ( $\lambda$ pir), which were plated on LB Tmp. Finally, gene knock-out via homologous recombination was attempted. An analysis of previously sequenced *B. ubonensis* revealed four gene targets with putative antibiosis capabilities. Knockout constructs were designed for SOEing PCR and a knockout plasmid, pEXKm5.

Transposon mutagenesis successfully created a *B. ubonensis* mutant strain with no antibiosis activity. Further research to identify the site of transposon gene disruption was done by *de novo* sequencing of mutant genomic DNA. The genetic characterization is still underway and we are awaiting analysis.

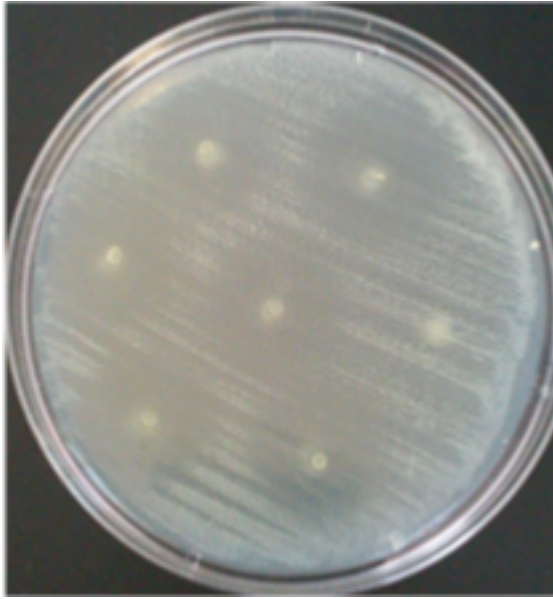


Figure 1: Growth Inhibition Assay displaying zones of inhibition against *Burkholderia thailandensis*.

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## RNAi Silencing of SSD1 in *Chlamydomonas reinhardtii*

Gracie Williams and Lucia Tejada  
Dr. Yoojin Choi  
Department of Biology

This research project involves the silencing of gene SSD1 by use of RNA interference (RNAi) in the unicellular alga *Chlamydomonas reinhardtii*. This gene of interest is a homolog of the



mammalian gene Patched (human gene PTCH1), a receptor for the protein Sonic Hedgehog. In mammalian cells, PTCH1 has a recognized function as a tumor suppressor gene. Extensive research has been performed to analyze the effects of mutations in the PTCH1 region in mammals, and mutations in this gene have consistently been related to both the development of embryonic structures and tumorigenesis (RefSeq, 2008). PTCH1 is located on the primary cilia of developing mammalian cells (Petralia et al., 2011). Because the *Chlamydomonas* flagellum is

very similar to mammalian cilia, it makes these algae a suitable model system for mammalian development (Silflow and Lefebvres, 2001). This research project's significance lies in its complete novelty—although its sequence points to expression of a sterol sensing 5-transmembrane protein, the veritable function of SSD1 in *Chlamydomonas* is currently unknown. (UniProt, 2007). Because SSD1 and PTCH1 are homologs, we hypothesize that the implications of our research and eventual knock-down of SSD1 function to be related to those of PTCH1. Ascertaining SSD1's function may allow us to discover functions of tumor-suppressor gene PTCH1 that are independent of Sonic Hedgehog functioning. To date, we have grown and maintained a *Chlamydomonas* colony, designed and obtained our target construct sequence for RNAi transformation, and obtained and isolated the RNAi vector plasmid RS300. The next steps of the project include insertion of our DNA sequence into the RS300 plasmid, cloning it, and using it to transform our *Chlamydomonas* colony using the standard glass beads protocol (Kindle, 2000). We will then perform a morphological observation and evaluation, and, depending on those results, make use of a series of behavioral assays (including a motility assay) to aid in determining the effects of the knock-down.

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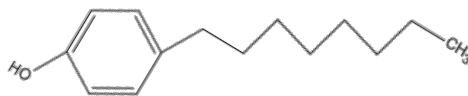
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## Structure and behavior of alkylphenols in humic acid

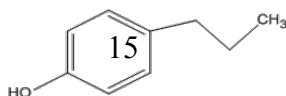
Emily Mordan  
Dr. Isabel Larraza  
Chemistry Department

### Abstract

Endocrine disruptors are a type of pollutant that mimic the structure of hormones. They induce endocrine imbalances in exposed mammals, such as fertility problems, developmental problems in children, cancerous tumors, etc.<sup>1,2</sup> Our research project aims to develop an understanding of the behavior of the endocrine disruptor 4-octylphenol in soil to assess its possible bioavailability and environmental impact. This study focuses on the interactions of 4-octylphenol and humic acid, a major organic component of soil to understand how 4-octylphenol may bind to soil. Earlier studies suggest that 4-octylphenol binds strongly to humic acid, and we suspect that the long alkyl chain may entangle in the humic acid structure.<sup>2</sup> To determine the impact of alkyl chain length on binding to humic acid, 4-octylphenol was compared to a molecule with shorter chain, specifically, 4-propylphenol. Initial qualitative FTIR studies showed that 4-octylphenol binds to humic acid over time while 4-propylphenol does not, indicating that alkyl chain length may be responsible. On the other hand, using the internal standard approach and Gas Chromatography-Mass Spectrometry we were able to quantify the extent of this binding through three different experimental setups. One tested the time dependency of interactions between alkylphenols and humic acid in a stationary mode. With the second method, we observed the impact of a shaken environment and its effects on these interactions. In addition, micelle chemistry was used to create an aqueous chemical environment and force greater contact between alkylphenols and humic acid.<sup>4,5</sup> Lastly, molecular dynamics simulations were used to develop a molecular-level picture of the equilibrium structures of humic acid<sup>3</sup> mixed with the alkylphenols. In conclusion, time had little effect on how much 4-octylphenol adsorbs to humic acid, but did impact the amount of 4-propylphenol adsorbed to humic acid. The shaken experiments showed us that stirring had little effect on the amount of alkylphenol that gets adsorbed compared to the stationary experiment. From the micelle experiment we can conclude that a closer proximity induces adsorption on both alkylphenols. These results were supported by the initial molecular models obtained.



**Figure 1.** Chemical structure of 4-octylphenol



**Figure 2.** Chemical structure of 4-propylphenol

## References

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## Mental Health Awareness and Knowledge of College Students

Rebecca DeKorne  
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Psychology Department

Studies have found common misconceptions and poor attitudes towards mental illness in the general adult population; this can prevent those individuals suffering from mental illness from seeking treatment (Angermeyer & Dietrich, 2005; Center for Disease Control and Prevention, 2010). Research has also shown a lack of accurate public knowledge regarding the symptoms, causes, and treatment options for mental illnesses (Jorm, 2000; Hugo, Boshoff, Traut, Zungu-Dirwayi, & Stein, 2003). Researchers have found mental illness to be highly prevalent among college students (Hunt & Eisenberg, 2010). However, little research has been done to show how knowledgeable college students are of this epidemic and the effect these illnesses may have on themselves and their peers. Thus, the aim of this study is to explore college students' accuracy regarding the symptoms and causes of mental illness, as well as where they report obtaining information on mental illness.

Participation was offered to undergraduate students of any department. Participants completed an online survey including a number of vignettes followed by questionnaires regarding the causes and treatment of the behavior found in the vignettes. Questionnaires inquiring about the students' sources of information regarding mental illness and past history with mental illness were also included. The survey was group administered in a computer lab and through a link to the survey through email/in-class announcements.

This study has been approved by North Park University's IRB. Data collection is complete with a total of 234 participants. Statistical analyses are currently being conducted. Thus, results have not yet been determined. The completion of this project is necessary for graduation.

Due to the inaccuracy of knowledge in the general public regarding mental illness, I hypothesize similar inaccuracies in this college student sample. I plan to conduct a Pearson correlation between age and knowledge. T-tests and ANOVAs will be completed to compare the mean knowledge scores between groups (i.e. gender, race, religion, year in school and whether an individual has personal, familial, or neither experience with mental illness). Descriptive statistics will describe where people obtain information about mental illness.

Since this study is exploratory and we have found no studies examining awareness in college students, any findings will be beneficial in providing a better understanding of mental health knowledge in students. The results of this study could be used in formulating interventions to increase awareness among college students, which may lead to early detection or reduction of negative outcomes of mental illness on college campuses.

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