

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

TUESDAY, APRIL 28, 2015

BRANDEL LIBRARY, NORTH PARK UNIVERSITY

CHICAGO, ILLINOIS

## PROGRAM

Event	Time	2 <sup>nd</sup> Floor Gallery	3 <sup>rd</sup> Floor Gallery
<b>Welcome</b>	3:30pm	Professor Yoojin Choi	Professor Peggy Kotowski
<b>Student Presentations</b>	3:35pm 3:50pm 4:05pm 4:20pm	Mary Aldugom (PSYC) Rebecca Byrne & Kirstin Lee (BIO) Erin Cronin (MUS) Kayla Covarrubias (CHEM)	Kelly Anderson (CHEM) Iain Chester (BTS) Samantha Wagner (PSYC) Brian Lam (BIO)
<b>Refreshments</b>	4:40-5:00 pm	2 <sup>nd</sup> Floor Gallery	
<b>Student Presentations</b>	5:00pm 5:15pm 5:30pm	Ahmed Massad (CHEM) Mallory Orth & Katherine Patterson (BIO) Elwin Clutter (CHEM)	Emily Mordan (CHEM) Brent Gustafson (BIO)
<b>Closing Remarks</b>	5:45pm	Professor Yoojin Choi	Professor Peggy Kotowski

*Following the symposium:* Discussion and dinner (served at 6:00pm) 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 Johnson and President Parkyn for their support and for underwriting the cost of the symposium.

# **AUDITORY AND VISUAL WORKING MEMORY DIFFERENCES IN MUSICIANS AND NON-MUSICIANS**

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## **ABSTRACT**

Several longitudinal studies have shown that children's auditory memory significantly improves after being placed in extended music programs (Roden, Kreutz, & Bongard, 2012; Dege, Wehrum, Stark, & Schwarzer, 2011). Studies have also shown that a significant correlation exists between years of formal music training and several sequential working memory tasks (Bailey & Penhune, 2010). A possible explanation of these findings relate to the importance of tonal manipulation in musicians. Musicians must learn techniques to recall tones and melodies in the correct order that is presented to them. This research study is designed to look into the differences in visual auditory and working memory in musicians and non-musicians. I predict musicians will perform better on working memory tasks that are sequential in nature compared to those that are not. Furthermore, musicians will perform better specifically on auditory working memory tasks than the non-musician participants.

To assess if musicians have superior serial auditory and visual working memory compared to non-musicians, three different working memory tasks of two modalities (3 x 2 experimental design) will be administered to Psychology and School of Music students in the Spring of 2015. The working memory tasks will be obtained from the third edition of the Wechsler Adult Intelligence Scale (WAIS-III). The Forward Digit Span, Backward Digit Span, and Arithmetic subtests from the Working Memory Index (WMI) will be utilized in this study. The materials from these subtests will be divided into two groups to form our auditory and visual memory task conditions. Participants will be asked to complete an auditory and visual Forward Digit Span task, an auditory and visual Backward Digit Span task, and an auditory and visual mental Arithmetic task. The auditory working memory tasks will be verbally administered while the visual working memory task will be presented to subjects through a presentation on a screen. Responses will not be timed, however correct responses will be recorded.

This study is still in progress, and results are still pending. However, I hypothesize that musicians will be superior to non-musicians in the serial immediate auditory memory tasks. With the extent of training musicians receive in remembering tones and notes in specific orders, I believe that musicians are able to recall serial information better than non-musicians.

If the results were to show that musicians have a superior serial auditory memory than non-musicians, it will add to the knowledge base of musicianship and its effect on memory.

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Future research could delve into the specifics of musicianship and the factors that impact auditory memory the way that it does. This would help researchers in the field to have a better understanding of what it is about musicianship that opens these doors to obtaining a superior aspect of cognition. Not only would researchers and professionals in the field gain knowledge, these results could help musicians gain insight on their own memory and their own capabilities.

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# STUDENT PERCEPTION OF SUPPLEMENTAL INSTRUCTION IN INTRODUCTORY CHEMISTRY

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## ABSTRACT

The purpose of Supplemental Instruction (SI), is to assist students through guided peer-led study sessions, with the goal of improving student performance and study skills in classes where students frequently struggle.<sup>1-4</sup> By working in groups and interacting with a peer instructor, students are expected to gain a deeper understanding of the material. Other studies have indicated that students who frequently attend SI achieve higher grades.<sup>5-7</sup> However, student buy-in is necessary for such a program to be successful. The goal of this study is to develop an understanding of how students perceive their time in SI is spent, and how this correlates to their satisfaction with the program. Student perceptions of how time in SI is used are collected via surveys at each SI session. These are compared to classroom observation data to determine how accurately students perceive their time spent in SI. This data is correlated to student satisfaction levels, as measured by weekly surveys to understand how student perceptions of how their time was spent impact buy-in. The targeted students are enrolled in introductory organic chemistry and biochemistry, a class required for admittance to the School of Nursing that is often a barrier to success for pre-nursing students.<sup>8</sup> Through observation and survey research, we can obtain an understanding of how students' perceive SI, and we can use this information to develop better ways to increase student buy-in to this beneficial program.

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# SURVEILLANCE FOR *ANAPLASMA PHAGOCYTOPHILUM* IN THE CHICAGOLAND AREA

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## ABSTRACT

Our research focused on a gram-negative bacterium carried by *Ixodes scapularis* (the black-legged deer tick) called *Anaplasma phagocytophilum* (Minnesota Department of Health 2014). This is the causative agent of human granulocytic anaplasmosis, which is known as HGA. This disease is characterized by fever, headache, chills, and muscle aches (CDC 2013). HGA is endemic to the Midwest and Northeast parts of the United States, and it is extremely difficult to diagnose due to the vagueness of the symptoms. This is why our current effort in conducting pathogen surveillance among tick populations is essential for diagnosis in the area. Screening for *A. phagocytophilum* is a continuation of previous work done by North Park University Students.

Tick specimen collection throughout the Chicago-land area was conducted by using a flannel drag method. The tick's mid-guts were extracted and the DNA was isolated. Specific DNA sequences were targeted with a short strand of base pairs called primers, specifically Ehr-521 and Ehr-790, in polymerase chain reaction. PCR is used to reproduce multiple copies of specific sections of the DNA and is done in three different steps: denaturation, annealing and extension (Stopler 2014). After the PCR was complete, the samples underwent gel electrophoresis. Gel electrophoresis allows for identification of PCR product by their weight. DNA is placed in wells and pulled to the end by a negative charge. The results were viewed under ImageLab software. The presence of *A. phagocytophilum* was indicated by a band at the 290 base pair fragments and a Hi-Lo DNA ladder was used for reference. The samples that were positive for the pathogen were cloned and sequenced.

Once positive *A. phagocytophilum* samples were identified, they were analyzed for potential pathogenicity. In a recent study in Canada (Krakowetz, 2014), two separate strains of *A. phagocytophilum* were identified within the infected pool of ticks. One strain, Ap-ha, is associated with most cases of HGA in its prevalent incidence areas, including the upper Midwest and Northeast. The Ap-variant 1 strain has been identified as non-pathogenic, which means it does not appear to produce illness in humans. To avoid non-specific binding of DNA during PCR, two rounds must be performed using two different sets of primers, with the second set binding a target sequence within the first product. This method is called nested PCR, and was conducted first using primers Ge3a and Ge10r, then using primers Ge9f and Ge10r, to amplify a

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region on the 16S rRNA gene within the DNA of those ticks who tested positive for *A. phagocytophilum*.

This product then undergoes restriction fragment length polymorphism (RFLP). This allows molecular differentiation of the two strains by using the enzyme *Kpn2I*. The 919 bp amplicons for the Ap-ha strain would remain intact after restriction digest, exposing its identity as member of the pathogenic strain. Ap-variant 1 positive samples would produce two separate bands near ~360 bp and ~550 bp.

The RFLP analysis thus far has detected two potential Ap-variant 1 strains, and one potential Ap-ha strain from infected ticks in the Chicagoland area. Of the 160 ticks surveyed, there were three ticks which identified as positive for *A. phagocytophilum* infection, and three unsequenced potential positive ticks. Of these six ticks, two have been identified as Ap-variant 1 non-pathogens. It is critical that continued surveillance of ticks in the Chicagoland area occurs in order to accurately diagnose and treat cases of HGA. If the Ap-ha strain is detected in the *A. phagocytophilum* population being circulated among ticks in the region, it would reveal a serious health threat to those living in the Chicagoland area.

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# **1 PETER 2:1-10: A CALL TO BE A MESSIANIC CHURCH**

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## **ABSTRACT**

This paper was written for a senior seminar class in the Biblical Studies department. Therefore the purpose of the paper was to show a developed and thorough interpretation of a biblical passage using the practice of Theological Interpretation of Scripture (TIS). The paper takes the passage 1 Peter 2:1-10 and interprets the text through the practice of TIS. TIS is a process of interpretation of scripture which acknowledges the importance of the scholarly practice of historical critical exegesis but also recognizes that historical-critical exegesis cannot stand alone in interpreting and understanding a text. Historical-critical exegesis attempts to read a text within its original linguistic, cultural and historical context. TIS recognizes that this type of interpretation falls short. Therefore, TIS not only takes into account historical-critical exegesis, but also attempts to interpret a passage by examining its relationship to the canon of scripture, its place in church tradition and its place in past scholarly work. By taking a more holistic approach to a passage TIS hopes to make the text relevant not only for the scholar but also for the Church. This desire to present something useful for the church is the essence of TIS.

This paper attempts four things with concern to 1 Peter 2:1-10. Firstly, to not only provide a historical and theological context to the passage itself but to put it within the context of the First Epistle of Peter. Secondly, to present an exegesis of the passage that takes into account a wide variety of scholarship. Thirdly, to examine a major theme of the passage, in the form of the living stone, and examine this theme in relationship to other parts of scripture, mainly Romans 9:32-33 and Isaiah 8:14-15, in which this theme occurs. Lastly, the paper will examine the way in which Luther used this passage, how Luther's arguments have been misappropriated and what this means for the church today. This paper will aim to maintain a balance in representation of the major themes of the passage as well as maintaining a balance between historical and theological analysis.

The paper concludes that firstly, throughout historical contextualization of the entire book of 1 Peter we can see that this text is not only for those under oppression or persecution because of their faith. Instead it is for the entire church and is designed to encourage us to live a life that reflects our belief in the messiah. Moving through the passage and noting its meaning it is again possible to see that the text is intended to give any Christian, even today's Christian, an insight into the character of Christ but also into ourselves as Christians and even as converts. Christians

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are to be like the ‘living stone’ and remain active and growing in their spirituality as a chosen person of God. The rest of scripture continues to support this call for Christians to follow Christ’s life and also continues to state that for some Christ will prove a stumbling block. This serves to strengthen our faith in Christ and encourage us to live a messianic life, one that lives in light of Christ’s living. Lastly, through Luther and history’s interpretation of Luther it is possible to see that this text is important in establishing that a life in Christ is built upon Christ and that opportunity to live that life is open to all. As a part of this life we are all called to give testimony and preach the Gospel and live a messianic life but through this we all come to salvation and to Christ. This paper makes a contribution to the field by identifying TIS as a method of scholarly interpretation and giving an example, in 1 Peter 1-10, of how TIS is done and the implications it can have.

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# A SHORT, GREEN SYNTHESIS OF PROTON PUMP INHIBITORS

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## ABSTRACT

Green Chemistry follows twelve principles to synthesize compounds in a manner that is better for the environment and safer for the chemist. For the proposed synthesis, compliance with four of the principles will help make it greener than the current synthesis: waste prevention, energy efficiency, maximizing use of materials, and using chemicals that have low toxicity.

Gastric ulcers can occur from excess secretion of hydrochloric acid from parietal cells in the stomach. Proton pump inhibitors (PPIs) are currently the most effective agents to decrease the amount of acid by directly targeting the pump in those cells that release positive hydrogen ions, or protons.

Because PPIs are among the 100 top-selling drugs in the USA and generate sales of several billion dollars, their synthesis has been the objective of numerous studies.<sup>1</sup> The purpose of our research was to design and develop a new, short, preparation of PPIs under green conditions, which would lower the cost and time of the synthesis as well as making the production energy efficient and less harmful to the environment.

The most popular brands of PPIs (Prevacid®, Prilosec®, Protonix®) share a common basic structural nucleus shown in Figure 1. It consists of a benzimidazole section (AB) which is attached to a pyridyl ring (C) through a methansulfinyl bridge (bold). Each brand is characterized by different substituents in AB and C.

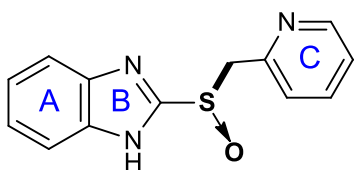


Figure 1

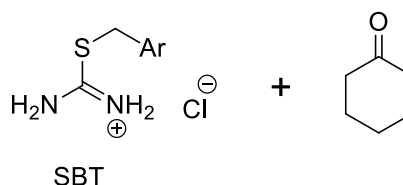


Figure 2

The conventional method to prepare these PPIs involves a multistep process, which synthesizes the AB section separately and then attaches C. This method usually includes the formation of intermediates under harsh conditions and/or use of toxic materials like thionyl

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chloride.<sup>2</sup> Our approach proposes to form the basic system in one operation thru the condensation-aromatization of S-benzylisothiuronium chloride (SBT) derivatives<sup>3</sup> with substituted cyclohexanones (Figure 2) under microwave-assisted heating. A subsequent oxidation reaction would reduce this synthesis to a total of three steps, and it would be one of the shortest routes for the preparation of PPIs under green conditions.

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## IMPACT OF WRITING-TO-TEACH ACTIVITIES ON EXPLANATORY WRITING

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### ABSTRACT

A significant focus of science, technology, engineering, and math (STEM) education is to develop methods that will engage students in their learning.<sup>1-3</sup> Previous research supports the writing-to-teach method as a way to improve student engagement and learning. In writing-to-teach assignments, teams of students work together to create learning resources for their classmates.<sup>4-6</sup> The goal of this study is to understand how different types of writing-to-teach projects impact students' achievement, students' engagement with chemistry, and students' ability to write explanations about scientific phenomena. Writing-to-teach projects were introduced to students enrolled in Survey of Organic Chemistry and Survey of Biochemistry courses. In one semester, teams of students created writing-to-teach documents in the form of a class wiki. In the following semester, teams of students edited and expanded upon the wikis made in the first semester. Student achievement was assessed through grade comparison. Student engagement was assessed through surveys which were given at the beginning and end of each semester.<sup>7-8</sup> The impact of the two types of writing-to-teach activities on student explanatory writing were compared using a coding system that scored writing samples from both groups.<sup>9</sup> Student achievement and engagement were not significantly impacted by the different types of writing-to-teach activities. However, results showed that students who edited and expanded upon their peers' writing wrote better explanations on the writing samples. These results can help refine the types of writing-to-teach activities that best improve student learning.

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## GETTING TO KNOW EDWARD: NARRATIVITY IN BRAHMS' *Op. 10* AND *Op. 75*

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### ABSTRACT

Johannes Brahms first came into contact with the folk ballad "Edward" through Johann Gottfried Herder's collection of folk songs, *Volkslieder* in 1854. Brahms immediately composed a corresponding piano piece based on the folk ballad as his *Op. 10*, No. 1 and later returned to the poem again in 1877, this time setting it as an art song duet for tenor and contralto in his *Op. 75*. Very little has been published concerning the comparative analysis of these two works, particularly in the examination of narrativity.

This analysis takes the narrative as a point of departure and shows how a developing understanding of the characters undergirds Brahms' musical discourse in both and demonstrates how Brahms utilized characterization as the foundation for his interpretation of the *Edward* ballad, an interpretation that remained consistent many years later in his *Op. 75*. Through a close examination of the two main themes within the compositions, this research examines the ways in which Brahms depicts the characters of Edward and his mother as individually and distinctly deceptive, the uneven power dynamic that defines their relationship, and the character development within the compositions that directly mirrors the literary ballad. A deeper understanding of ways that Brahms utilized tonality, texture, and meter in his *Op. 10* and *Op. 75* not only sheds light on the way in which he interpreted the poem, but furthermore draws into question the abilities and limitations of instrumental music to communicate narrative effectively.

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# **MATK SEQUENCE ANALYSIS FOR HOST PLANTS SURVEY OF INVASIVE SPECIES JAPANESE BEETLE (*POPILLIA JAPONICA*) BY USING BARCODE OF LIFE DATABASE**

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## **ABSTRACT**

The Japanese beetle, or *Popillia japonica*, is an invasive species that damages crops in the Midwest and other areas. It is possible to genetically analyze the host plants and analyze the feed pattern of the beetles to further predict potential host plants. Sequencing data of the *rbcl* gene were used for preliminary analysis. Another gene region, *matK*, is a highly variable sequence in many species and is also valuable for DNA barcoding. The objective of this study is to perform sequencing with the second gene, *matK*, to further confirm the identification of host plants.

Fifty-five samples of DNA from different plant species on which Japanese Beetles feed were extracted for sequencing. In an attempt to establish a large-scaled survey model for invasive species, DNA barcode database, Barcode of Life, was used to identify host plants and their relation. Preliminary analysis was done using the *rbcl* gene. We used *matK* primers developed by The Chinese Academy of Sciences which had a 93.1% amplification rate in angiosperms to amplify the *matK* region. We tested the universality of these same primers using the BLAST tool from the National Center of Biotechnology Information for the 55 samples in our study. Barcode of Life databases were used to find sequenced regions of *matK* DNA to test our primers. The DNA from the study samples was amplified with PCR using these universal primers and sent for sequencing. A phylogenetic tree was created using the sequenced *matK* data to supplement the phylogenetic tree created from the *rbcl* region. We hope to establish a straightforward model for large-scaled surveys on invasive species using both *matK* and *rbcl* regions of chloroplast DNA.

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# SEARCHING FOR GENES RESPONSIBLE FOR A POTENTIALLY NOVEL ANTIBIOTIC COMPOUND IN *BURKHOLDERIA UBONENSIS*

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## ABSTRACT

*Burkholderia pseudomallei* is the causative agent of melioidosis, a disease that is endemic to tropical climates and developing regions. Because of the disease's ambiguous and non-distinct signs and symptoms and the general lack of understanding, precautions, and subpar diagnostic laboratories (Currie, 2000; Inglis, 2001), mortality rates are near 25%. Due to these characteristics and its low infectious dose, *B. pseudomallei* is given precedence by the Centers for Disease Control and Prevention as a potential bioweapon (Wiersinga, 2012).

Existing in the same environment as *B. pseudomallei* is *Burkholderia ubonensis* – a bacterial species that has an antagonistic effect on the growth of *B. pseudomallei*. The overall focus of this project is identification and isolation of the inhibitory compound secreted by *B. ubonensis* against *B. pseudomallei* (Marshall, 2010). We used *Burkholderia thailandensis* as a surrogate for *B. pseudomallei* because it is a close genetic relative and safer to manipulate at biosafety level 2 conditions (Brett, 1998). The study could lead to further research on the control of *B. pseudomallei* thereby potentially decreasing environmentally acquired infections. The immediate goal is to find the gene(s) responsible for the inhibitory compound.

First we needed a growth inhibition assay. *B. ubonensis* is grown on nutrient agar plates for three days. *B. thailandensis* is then plated on the other side and incubated for a day. The inhibitory compound created by *B. ubonensis* is diffusible through the medium, so a zone of clearing can be seen on *B. thailandensis*, signifying inhibition. We then used this assay to test mutants we created using a transposon system. Transposon mutagenesis is a process that causes random disruptions in the genes of a cell. This occurs through the use of transposons, a genetic tool that mobilizes segments of DNA and inserts them in other locations. This allows researchers to speculate the function of the gene based on how the mutant strain acts.

Our gene(s) of interest are those responsible for the antagonistic compound in *B. ubonensis*. Because we do not know the location of these gene(s), we subjected a *B. ubonensis* cells to transposon mutagenesis and screened for the strains that no longer produced the compound, signifying that the mutation has occurred in the targeted gene(s). This is made possible by the use of the T23 transposon because unlike other transposons, T23 will only cause a single mutation (Gallagher, 2013). Thus, there will be one mutation per cell. To select the

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strain with the desired mutation, the cells in the pool were tested individually using the before-mentioned growth inhibition assay. *B. ubonensis* that has been mutated to inactivate the antagonistic compound will be associated with healthy *B. thailandensis* growth. Of the 6,762 genes that *B. ubonensis* has (Representative, 2015), we assume different mutations 600, one of which had the desired phenotype.

Future work calls for the DNA to be extracted and the disrupted gene to be identified. The gene could then be incorporated into a new strain of bacteria and manipulated to produce the compound. With this information, we can more accurately assess the compound's ability to kill *B. thailandensis*, environmentally, in culture, and clinically. This is important given the extreme antibiotic resistance of *B. pseudomallei* and the difficulty of treating it with current antibiotic regimens. It will also provide us with a better understanding of microbial antagonism.

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## SYNTHESIS OF A-HYDRAZINO ESTERS WITH MICROWAVE ASSISTED HEATING: GREEN CHEMISTRY APPROACH

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### ABSTRACT

Many  $\alpha$ -hydrazino esters are found in potent biologically active compounds. For instance, they are known to be components of pharmaceutical agents like *carbidopa*,<sup>1</sup> a drug used in the treatment of Parkinson's disease (See Figure 1, where the hydrazino-acid moiety derived from the ester is highlighted), or as precursors of antibiotics (vancomycin and amoxicillin) and of drugs to treat hypertension (enalapril).<sup>2</sup>

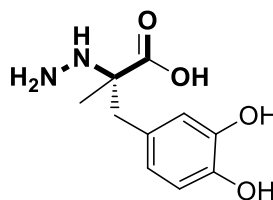


Figure 1

Because of this, the chemistry and preparation of hydrazino esters have drawn great interest. Our own research group has been engaged in the design and development of a short, clean, and high yielding synthesis of these important compounds, which also follows the principles of green chemistry. Our methodology consists of two parts: first, the preparation of different acyl-hydrazones of  $\alpha$ -keto esters, like methyl pyruvate that would provide the  $\alpha$ -nitrogenated-ester portion of the desired products in the form of neutral, stable intermediates; second, the reduction of these intermediates to the final products. The synthesis of the acyl-hydrazones, the first part, has been already explored and effected with great success by a former member of our group.<sup>3</sup> To complete this project, my research has involved three areas of research:

1) Design and implement the second part with an effective reduction method of the mentioned acyl-hydrazones by using tetraethylammonium formate or Hantzsch esters. These are efficient hydrogen transfer agents that have never been used in these types of substrates. Additionally, for this step we have replaced the required heating of the reaction mixture at high temperatures for several hours, with microwave-assisted heating and thus shorten the reaction times and increase the energy efficiency of the process.<sup>4</sup> This concept supports the green chemistry principle number 6, which is "Design for Energy Efficiency".<sup>7</sup>

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2) The innovative preparation of optically active acyl-hydrazones using chiral starting materials, like proline hydrazide, and then effect an stereoselective reduction in the second step.<sup>5</sup>

3) Effect both reactions in one step, i.e. develop a “one-pot” procedure by doing a reductive amination of methyl pyruvate with different carbazates. Likewise, this reaction has not been attempted before.<sup>6</sup> A successful implementation of this one-pot strategy would comply with green principles number 1 and 2: “Prevention of Waste” and “Atom Economy.”<sup>7</sup>

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## SURVEILLANCE FOR *BORRELIA SPP.* IN THE CHICAGOLAND AREA

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### ABSTRACT

Our research is focused on identifying the pathogens carried by *Ixodes scapularis* (the black-legged deer tick) in the Chicagoland area. Ticks can carry a number of infectious microorganisms, including *Borrelia*, *Anaplasma*, and *Babesia*, which can be pathogenic in both human and animal populations. This work has focused on one genus specifically, *Borrelia*, which includes *Borrelia burgdorferi* sensu stricto, the causative agent of Lyme disease, and *Borrelia miyamotoi*, a newly emerged disease causing relapsing fever in humans<sup>2</sup>. Cases of human *B. miyamotoi* infection have been identified in Japan, Russia and the Eastern United States<sup>1,3</sup>. Given this, surveillance for *B. miyamotoi* in areas known to harbor other *Borrelia* spp. is essential for *Ixodes* endemic areas. Continued characterization of *B. burgdorferi* sensu stricto is also important to better survey the presence of both pathogenic and non-pathogenic *Borrelia* spp. in the area.

Tick specimens were collected around the Chicago area by using a flannel drag. Tick mid-guts were extracted and DNA was harvested from this tissue. From this DNA, polymerase chain reaction (PCR) was performed using specific primer sets targeting the *ospA* and *ospC*<sup>4</sup> genes for *B. burgdorferi* and an intergenic spacer (IGS) region in *B. miyamotoi*. PCR is a method in which a single target gene sequence is amplified to generate millions of copies with the use of specific primers (short DNA fragments that match up with both ends of the target gene sequence and allow for replication). After the samples underwent a nested PCR (a second PCR reaction targeting a more specific sequence with a greater yield), the results were visualized with gel electrophoresis, which can differentiate DNA fragments based on size. The identity of *B. miyamotoi* is implied by the presence of a band at 550 base pairs, using a Hi-Lo DNA Ladder as reference, while the related pathogen *B. burgdorferi* sensu stricto band is around 1,000 bp. Additionally, we will amplify and sequence *ospA* and *ospC* genes of *B. burgdorferi* sensu stricto. These genes will determine strain subtypes and help predict potential pathogenicity in humans.

Of the 175 ticks tested, 1 had bands indicative of a co-infection of *B. miyamotoi* and *B. burgdorferi*. These results will be confirmed by conventional DNA sequencing methods. For *ospC* analysis, 37 samples were tested with 16 showing positive results; a 43% prevalence within ticks in the pool. We are awaiting sequence results for analysis.

Molecular testing will continue in order to evaluate *B. burgdorferi* within the tick population and monitor for *B. miyamotoi*. In the event that *B. miyamotoi*'s presence is confirmed in the region, health care professionals will be notified. Additionally, we will sequence, analyze

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and upload data from *ospC* genes recovered to clarify the picture of potential risk on Lyme disease in the Chicago area.

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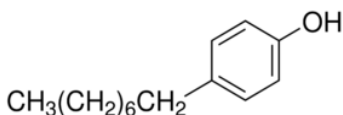
## STRUCTURE AND BEHAVIOR OF ALKYLPHENOLS IN DIFFERENT CHEMICAL ENVIRONMENTS

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### ABSTRACT

A major concern in industrial chemistry is the management of potentially dangerous waste in the environment. One class of pollutants, called endocrine disruptors, is a class of compounds that are structurally similar to hormones. These compounds can alter normal endocrine function of animals exposed to them.<sup>1-5</sup> This project is a study of the interactions between the suspected endocrine disruptors alkylphenols (Figure 1), and the soil component humic acid<sup>6,7</sup> (Figure 2) to understand how alkylphenols bind to soil using vibrational spectroscopy. Long chain alkylphenols have been shown to bind tightly to soil while other types of endocrine disruptors bind reversibly.<sup>8-9</sup> The strength of endocrine disruptor-soil binding largely determines the bioavailability of the endocrine disruptor. Thus it is important to understand how different endocrine disruptors bind to soil to aid in the development of environmental remediation methods. Here, alkylphenols with different chain lengths are exposed to humic acid, and vibrational spectroscopy is used to determine how alkylphenol chain length impacts the binding to humic acid. Further, unexpected changes in the vibrational spectra of alkylphenols in different solvents are investigated to determine how solvent impacts alkylphenol structure, as these structural changes may impact the interpretation of vibrational spectra of these compounds.



**Figure 1.** Chemical structure of 4-octylphenol, a long chain alkylphenol

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# **GENDER DIFFERENCES AND HEALTH CHANGE: PHYSICAL AND PSYCHOLOGICAL CHANGES IN STUDENTS ENROLLED IN *STRESS AND HEALTH***

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## **ABSTRACT**

The purpose of this study was to evaluate the effect of gender on physical and psychological changes. Data was collected over an eight week course designed to educate about stress and health.

## **RATIONALE**

Mental and physical health are both important aspects for college age individuals. Research shows that males in this age group report better health-related quality of life than females (Jorngarden, Wettergen, & von Essen, 2006). Furthermore, one study indicates that males scored higher than females on all scales of the SF-36, a short self-report health survey (Hopman et al., 2000). However, there is not much empirical support for gender differences in health markers within college students. This research study aimed to evaluate the discrepancy by examining how gender moderates physical and psychological changes following an eight week college course on stress and health.

## **METHODS**

This descriptive study looked at how gender moderates the impact of health intervention, and was a part of a larger quasi-experimental study that examined the effectiveness of paper versus electronic behavioral monitoring. With the data gathered, the moderating effect of gender on physical and psychological changes were evaluated. Data was gathered using the SF-36, which was administered to the subjects prior to the eight week course and again at completion. T-test regressions were used to evaluate the correlation between the variables of gender and change in health markers, such as cardiorespiratory health.

At this time, approximately one hundred students enrolled in a stress and health course participated in this study. The ages of these participants ranged from 18 years of age to approximately 35 years of age.

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## RESULTS

For physical changes, pre-assessment cardiorespiratory fitness, as measured by a step test, differed significantly by gender. Male participants demonstrated superior cardiorespiratory health by maintaining a lower increased heart rate ( $M_m=11.02$ ) in comparison to females ( $M_f=23.97$ ). Post course results did not show a significant change ( $M_m=11.00$ ,  $M_f=21.30$ ). The difference between the change scores within gender approached significance.

For psychological changes, there were no significant pre-assessment, post-assessment, or change score differences. Further data collection is ongoing.

## CONCLUSION

Data collected and analyzed thus far include approximately one-third of the projected overall data pool. Preliminary results show that significant changes occurred within some physical changes. Additional data collection will occur during early 2015, which will provide further support and representation of subject data.

This research study aimed to evaluate how gender moderates physical and psychological changes following an eight week college course on stress and health. There are significant findings between genders in some physical changes. These findings add to literature that gender differences exist in certain health markers, but fail to confirm some data that examine health differences across all ages of adulthood.

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