

# 6<sup>th</sup> Annual North Park University Undergraduate Research Symposium

Tuesday, April 17, 2012

North Park University  
Brandel Library  
Chicago, Illinois

## Program

Event	Time	Session
Welcome	3:30–3:35 pm	Dr. Rachel Schmale
Session 1	3:35 pm 3:50 pm 4:05 pm 4:20 pm	John-Tyler Carlson Rachel Hudgens Amal Massad Sarah Soffel
Break	4:20-4:35 pm	Refreshments
Session 2	4:35 pm 4:50 pm 5:05 pm 5:20 pm	Trevor Stillin Evan Koubsky Jeff Ganim Matthew Baumer
Closing Remarks	5:20–5:25 pm	Dr. Matthew Schau

Following the symposium: Discussion and dinner (served at 5:45 pm) for presenters and advisors in Olsson Lounge, Seminary Building.

## Acknowledgments

We wish to thank the students and faculty mentors for their efforts at creating original works of knowledge. This year's event planning committee consisted of Profs. Joe Alulis, Leona Mirza, Kelly Potteiger, Jon Rienstra-Kiracofe, Matthew Schau, and Rachel Schmale. Special thanks to Dean Charles Peterson and Provost Joseph Jones for their support and for underwriting the cost of the symposium.

# The Design of a Guided Inquiry Gas Chromatography Experiment for Introductory Organic Chemistry

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## ABSTRACT

In this research project, a new laboratory was designed for an introductory organic chemistry course. The goal was to design a guided inquiry experiment in which the students get hands-on experience with modern technology and use principles learned in the classroom to solve a problem. In guided inquiry laboratories, students use experimental results to answer more open-ended questions. Research studies have shown that using guided inquiry in the laboratory improves learning and interest in the subject matter (Briggs et al., 2011, Schoffstall and Gadis, 2007). This experiment also introduced students to the technique of gas chromatography (GC). GC is a powerful analytical technique used to separate and identify components of a mixture. GC is used in many fields such as pharmaceutical research, forensics and environmental testing. Instrumentation such as GC is rarely used in introductory laboratories due to time constraints, equipment cost and the large number of students taking introductory courses. However, it is expected that using such advanced instrumentation in introductory laboratories will increase student interest (Milner-Bolotin, 2012).

The experiment was designed to use the Vernier Mini Gas Chromatograph. These instruments are ideal for an introductory laboratory because they are easy to use, although they are limited in the types of compounds they can successfully analyze (Vernier, 2012). Another constraint in the experiment design was that all the students needed to complete the experiment within strict time constraints. In the newly designed experiment, students are given an unknown sample that is a mixture of several chemicals, as well as several pure samples of possible constituent chemicals that could be part of the mixture. The students analyze both the known samples and the unknown mixture using the GC to determine the composition of the unknown mixture. In the laboratory report, students have to explain their results using what they know from class, and they have to predict what a chromatogram of similar compounds would look like based on their results.

In designing the experiment, many trials were conducted using different compounds to determine what produced the most easily interpretable chromatograms. Then, trials were conducted to find the optimum conditions for the CG experiments. Conditions were optimized to produce the clearest chromatograms in the least amount of time possible. A trial run of the lab was

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performed with students who had already taken the introductory organic chemistry course. When the lab was tested the students were able to complete the lab within the given time constraints and were able to derive which compounds were in their unknown mixture showing that they understood the concepts that were intended to be taught. The experiment has since been performed in the course and student feedback was positive. This project demonstrates the design of a guided inquiry experiment using advanced instrumentation in introductory courses with a large number of students. Students were able to successfully complete the experiment and had positive feedback about their experience.

# MLST analysis of *Borrelia* Isolates from the Chicagoland Area

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## ABSTRACT

*Borrelia burgdorferi* sensu stricto is the causative agent of Lyme disease in the United States (Steere *et. al*, 2004). In 2010 there were 135 cases of the disease confirmed in Illinois according to the CDC. Recent work has demonstrated the presence of this organism in the greater Chicagoland area (Jobe *et. al*, 2006, Jobe *et. al*, 2007). This work focused on a small number of *Borrelia* isolates from deer ticks, *Ixodes scapularis* (the vector for the organism). In addition, genotyping analysis of *Borrelia* isolates from the meadow vole *Microtus pennsylvanicus* (a common reservoir for the organism) from the same region demonstrated the presence of the novel species, *Borrelia kurtenbachii*, a strain that is not definitively pathogenic (Margos *et al*, 2010). In light of this finding, we felt further characterization of *Borrelia* isolates from *I. scapularis* was critical to understanding the risk of disease acquisition in the Chicagoland region. MLST (multilocus sequence typing) analysis is used to characterize intraspecific strain relationships using ~500 bp of DNA sequence data from a set of eight housekeeping genes (Robinson *et. al*, 2010). Using polymerase chain reaction with specific primers, these housekeeping genes were amplified from ten Chicago isolates and sequenced. To date, five genes have been sequenced and compared to the wild type strain (B31) for *B. burgdorferi* sensu stricto. The results of this analysis have revealed that the isolates tested are at least 97.76% identical to their corresponding sequences in *B. burgdorferi* sensu stricto. Complete MLST analysis will allow a final determination as to the exact strains of *Borrelia* each of these isolates represents. These findings could benefit Chicago area health care providers in the diagnosis of Lyme disease and provide the public with a better understanding of the relative risk of acquiring Lyme disease from a tick bite in the Chicago area.

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# Suzanne Haïk-Vantoura’s Attempt to Decipher the “Music of the Bible.”

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## ABSTRACT

Suzanne Haïk-Vantoura claims to have accurately deciphered the musical value of signs in the Hebrew Bible—signs which are often called, “cantillation marks”—and in so doing, recovered the original music of the Bible going all the way back to the time of Moses. (Haïk-Vantoura, 1991) And while many scholars have criticized her thesis, their critiques often take an “all or nothing” approach to Haïk-Vantoura’s work. (i.e. Werner, 1982) However, this approach neglects possible important contributions of her work, which, even if she has not accurately deciphered the musical value of the signs, may be helpful in future attempts to do so.

Haïk-Vantoura’s attempt to decipher the cantillation marks of the Hebrew Bible will be examined. This should be helpful in order to bring to light the value of her work for scholarship, to examine the accuracy of her controversial claims, and to help guide future research into the musical value of the marks. Haïk-Vantoura’s work will be examined by comparing it with the relevant historical evidence, scholarly studies of the marks, and other attempts to decipher the musical value of the signs.

Haïk-Vantoura, contrary her predecessors, sought to find the musical value of the signs by investigating them primarily as *musical signs* that *differed* from traditional interpretations of them. In doing this, she gave heed to the reputable scholars who recognize musical expression as their primary function, and she also gave heed to the scholars who recognize that the signs may differ from their interpretation in traditional Jewish communities. (Yevin, 1980; Revell, 1977) She also appears to be the only one to have offered an explanation as to why certain of these signs appear only *below* the Hebrew text, and certain of the signs appear only *above* the Hebrew text. Examining Haïk-Vantoura’s work with the relevant evidence could help solve the enigma of the musical value of the marks, and so be valuable on multiple fronts. Understanding the musical value of the signs is important to Judaism, which considers the signs authoritative, and musically deciphering them could even uncover a musical tradition long predating the addition of the signs into the biblical text by medieval Masoretic scholars.

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# Voces del Desierto: Towards a Theological Anthropology of the Argentinian Indigenous Experience

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## ABSTRACT

The way in which eurocentric theology has traditionally conducted theological anthropology has been grounded in what M. Shawn Copeland calls a “theological displacement of human being with bourgeois European white male being”(Copeland 89). This is a perspective that denies the legitimacy of other cultural lenses in approaching a theological exegesis to the Gospel. Such a denial is binding, oppressive, and attempts to constrain the manifestation of God’s presence in the world to the experience of the dominant culture. In order to embrace a radical liberation of the oppressed, there must be a radical shift of the anthropological subject. In other words, rather than continue in a trajectory of marginalization and oppression, we must place those whose narrative has been shoved to the margins of our traditions at the center. The oppressed must become our point of departure (James Cone) – the point from which we begin in approaching a fuller understanding of the Gospel. Most fundamentally, the point from which we begin to attain an understanding of Jesus of Nazareth. The Christ. The Son of God. It is Jesus’ life and ministry it’s self that ask for this particular focus.

The major purpose of this project is to investigate an approach to theological anthropology, as it relates specifically to the Argentinian Indigenous experience. It attempts to address the ways in which racism, invisibility and silence hinder the development of embodiment within the construction of a local theological anthropology. In addressing the indigenous narrative and experience of racism through the lens of the gospel of Jesus Christ, it asks the question, “what does Jesus have to say about the indigenous experience of Racism in the North of Argentina?” It addresses this question using a theoretical framework based in African American and Latin American liberation theologies. The methodology for this paper involves use of primary sources, including qualitative data gathered in the form of first hand interviews, as well as primary sources in theology with occasional support from secondary sources as needed. This paper begins by grounding this theoretical framework in Paulo Freire's Pedagogy of the Oppressed, establishing a foundational understanding of the way in which radical leadership in opposition to oppressive forces calls for dialogue, love, humility, courage, and a reciprocity of influence

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between leader and the people. It then takes these assertions and claims them to be inherently biblical, grounding this claim in liberation theology. Then, serving as a case study, it presents qualitative research based on participant observation and in depth interviews conducted in Argentina using a methodology grounded in auto-ethnographic principles. Finally it works to identify both the solutions and the enduring questions that are raised in the midst of this study.

The expected outcomes hope to deepen an assessment of Copeland's concept of a praxis of solidarity; setting "the dynamics of love against the dynamics of domination" and grounding this effort in Jesus Christ. It works to emphasize the legitimacy of the Argentinean Indigenous lens towards a fuller theological anthropology; asserting that the experience of being embodied within the Argentinean Indigenous experience holds a particular claim to the truth of the Gospel of Jesus Christ. This project constructs a theological anthropology that offers that particular experience as an example of a marginalized experience that must be placed at the center.

# ospC analysis of *Borrelia* Isolates from the greater Chicago area

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## ABSTRACT

Lyme disease, caused by the bacterium *Borrelia burgdorferi* sensu stricto, is the most frequent vector-borne disease in the United States (Dykhuizen *et. al*, 2008). Recent studies have indicated the presence of *Borrelia burgdorferi* sensu stricto in the greater Chicago area (Jobe *et. al*, 2006, Jobe *et. al*, 2007). *ospC* genotyping can reveal the relative pathogenicity of *Borrelia burgdorferi* sensu stricto isolates. *ospC* genotypes can be classified into three categories; the first class is found in humans and it can disseminate into the blood and cerebrospinal fluid, the second class is found in humans and causes a localized skin infection, and the third has not been detected in humans to date (Dykhuizen *et. al*, 2008). Our work focused on determining the *ospC* genotype for a number of *Borrelia* isolates collected from *Ixodes scapularis* ticks, the vector for the organism, in the Chicagoland area. Polymerase chain reaction (PCR) was performed to amplify the *ospC* gene for each isolate. The resulting product was sequenced and compared to known *ospC* sequences in order to determine which *ospC* genotype is present in that isolate. These data will provide an idea of the relative risk of acquiring Lyme disease in the Chicagoland area. The data collected to date suggest that the percent of *Borrelia burgdorferi* sensu stricto in the most pathogenic category of *ospC* in the Chicago area is lower than other regions of the country, such as Minnesota and Wisconsin. In 2010, 135 confirmed cases of Lyme disease were reported in Illinois while Minnesota reported 1,293 confirmed cases and Wisconsin reported 2,505 confirmed cases (Center for Disease Control and Prevention, 2012). These data suggest a correlation between the *ospC* genotype profile for a region and the disease profile for that region.

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# Synthesis of 2-Methyl-oxazolines and 2-Methyl-oxazines: A Sustainable Approach

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## ABSTRACT

A great number of oxazine and oxazoline-containing natural products are present in many organisms. Likewise, oxazine and oxazoline nuclei appear in numerous medicinally and biologically active compounds. Because of this, their preparation has drawn great interest and is of importance in the synthesis of pharmaceutical compounds such as Relenza (Zanamivir), which is used to treat influenza, Oxaprozin sold as a nonsteroidal anti-inflammatory drug (NSAID), and Aminorex, an appetite suppressant. The most common mode for oxazoline synthesis involves several steps or the use of toxic, expensive reagents, which normally generate considerable chemical waste and/or rely on high energy demands. Therefore, the design of a short, milder and more efficient process, that follows the principles of green chemistry, would have a useful application in medicinal chemistry and therefore in the pharmaceutical industry.

We have recently studied the use of N-acetamido alcohols as viable precursors of 2-methyl oxazolines, 2-methyloxazines, and 2-methylbenzoxazoles. Our project relies on two innovative steps carried out in the same “pot”: 1) The selective mono protection of the starting amino-alcohols using a protocol developed in our labs. This is considerably more benign than the traditional method that uses carcinogenic materials and requires extensive workup procedures to isolate the final product. Thus, we have been studying different 1, 2- (for oxazolines) and 1, 3- amino alcohols (for the corresponding oxazines) and the conditions required for the mono-protection. 2) Treatment of the intermediate acetamido alcohols resulting from the first step, in the same reaction vessel, with DBH, an innocuous agent that would promote the cyclization with high atom efficiency. Our future plans will also include the use of microwave-assisted conditions to enhance the sustainability of our process.

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# Inhibition of Phosphodiesterase 10A Modulates Levodopa-Induced Dyskinesias in Parkinsonian Rats

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## ABSTRACT

Parkinson's disease (PD) is the second most common neurodegenerative disorder and affects over 1 million people in North America with 50,000 new diagnoses each year (Bove et al., 2005). Patients with PD share common cardinal symptoms, including resting tremor, rigidity, slowness of movement, and difficulty walking (Jankovic 2008). These symptoms develop as a result of the degeneration of neurons containing a chemical called dopamine (DA) that helps control motor behavior (Hornykiewicz 1975). Thus, the progressive loss of DA produces motor dysfunctions in patients with PD. The degeneration of DA-containing neurons is specifically observed in a region of the brain called the basal ganglia (Albin et al., 1995; DeLong and Wichmann 2007). In addition to motor deficits, the loss of DA-containing neurons in the basal ganglia produces an abundance of molecular and chemical changes in the brain that are poorly understood (Albin et al., 1995; DeLong and Wichmann 2007). Characterization of these changes is critical for understanding movement disorders, such as PD.

Treatments for PD have primarily focused on replacing the loss of DA tone in the basal ganglia through the administration of DAergic drugs such as L-DOPA. Currently, L-DOPA serves as the gold standard for treating motor symptoms in parkinsonian patients and produces vast improvements in movement (Olanow and Tatton 1999). However, after 5-10 years of treatment, patients often experience a "wearing off" of therapeutic effects, and eventually, debilitating L-DOPA-induced dyskinesias (LIDs) that may be as severe as the symptoms of PD (Olanow and Tatton 1999). Due to the limited utility of these drugs for treating patients with PD, it is crucial to investigate novel drug targets and therapeutic approaches in hope of further improving the treatment of PD.

Recent studies have shown that intracellular levels of cAMP and cGMP in a region of the basal ganglia called the striatum are reduced during the peak occurrence of LIDs in a parkinsonian rat model (Giorgi et al., 2008). Moreover, systemic administration of the non-selective cyclic nucleotide phosphodiesterase (PDE) inhibitor zaprinast was reported to reverse the decrease in striatal cyclic nucleotide levels, reverse dyskinetic behavior, and reduce the severity of dyskinesias in parkinsonian animals (Giorgi et al., 2008; Picconi et al., 2011). Unfortunately,

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drugs like zaprinast exhibit poor potency and produce undesirable side effects. Thus, better targets and drugs are needed. Given these findings, we hypothesized that selective PDE10A inhibitors could be useful therapeutic agents in the treatment of LIDs observed in patients with PD. The current studies assessed the utility of chronic administration (Monday-Friday for three weeks) of the selective PDE10A inhibitor TP-10 for reversing LIDs in a parkinsonian rat model.

Consistent with previous studies (Maries et al., 2006), the current L-DOPA regimen induced dyskinesias in the vast majority of rats, but not in vehicle treated sham- and 6-OHDA-lesioned rats. Co-administration with a high (3.2 mg/kg, i.p.), but not a low (0.32 mg/kg, i.p.) dose of TP-10 significantly attenuated LIDs observed in parkinsonian rats. These findings are consistent with previous studies which showed that non-selective PDE inhibitors such as zaprinast are effective for reversing dyskinetic behavior in animal models of PD (Giorgi et al., 2008; Picconi et al., 2011).

## Vatican II: Creating a Modern Church

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### ABSTRACT

Vatican II is the creation of a modern Catholic Church. The reason behind the Catholic Church's decision to call a Vatican II was to clear the air when it came to the use of modern science in the Church. In the previous council Vatican I, the use of modern science in the church was condemned because many of the church leaders saw modern science as compromising scripture. Vatican I prohibited students of theology within the Catholic Church from using modern methods of study. When Vatican II was called, it officially ended this practice within the Church. Vatican II was not only used as a way to modernize the Catholic Church, it was also used to correct the rejection of modernism in Vatican I.

In response to the enlightenment, Pope Pius IX issued his encyclical "The Syllabus of Errors." The Syllabus of Errors came out in 1862 and is a list of eighty propositions that the Catholic Church condemned. The syllabus' organization is interesting because it does not say outright that the church is specifically against the teachings of liberalism and modernism; it just assumes that the reader will understand that the church is taking a stand against these things. In regards to Modernism the syllabus said that it disagreed with the notion that "The Roman Pontiff can, and ought to reconcile himself, and come to terms with progress, liberalism, and modern civilization (Pius 1862, Article 80)." The syllabus condemned the idea that the pope should get rid of his temporal authority. In article 76 of the syllabus, Pope Pius IX sates that it is an error to believe that "The Abolition of the temporal power of which the Apostolic See is possessed would contribute to the greatest degree of liberty and prosperity of the church. (Pius 1862, Article 76)" The pope and the Catholic Church were determined to make sure that the power that they had held on to for hundreds of years would not be usurped without a fight.

In 1965 Vatican II promulgated its constitution "Dei Verbum." Dei Verbum allowed for a more liberal use of modern science when studying scripture. The Catholic Church promoted the use of Bibles in the common language of the many countries that had a Catholic presence. "Easy access to Sacred Scripture should be provided for all the Christian faithful...since the word of God should be accessible at all times, the Church by her authority and maternal concern sees to it that suitable and correct translations are made into different languages especially from the original texts of the sacred books (Catholic Church 1965, Dei Verbum Paragraph 22)." The Catholic Church wanted their faithful to have access to scripture so there could be a deeper devotion to

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the word. However, the authority to make statements regarding faith and morals was still left in the hands of the Pope. Dei Verbum also allowed Catholic Scholars to use modern criticism when reading scripture to provide a deeper exploration of scripture. What was seen as dangerous by Vatican I was now seen as a tool to, in the words of the council, “to effectively provide the nourishment of the scriptures for the people of God to enlighten their minds, strengthen their wills, and set men’s hearts on fire with love for God (Catholic Church 1965, Dei Verbum Paragraph 23).” Vatican II had corrected the rejection of modernism in Vatican I, by creating within the Catholic Church an atmosphere that allowed questions to be asked, and answered using modern research methods.

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