7th Annual North Park University Undergraduate Research Symposium

Tuesday, April 23, 2013

North Park University
Brandel Library
Chicago, Illinois

Program

Event	Time	Session
Welcome	3:30 pm	Dr. Jon Rienstra-Kiracofe
Session 1	3:40 pm 3:55 pm 4:10 pm 4:25 pm	Kaitlin Dailey (BIO) Miranda VanderMey (SOC) Alexander Czubak (CHEM) Deima Thompson (BTS)
Break	4:40-5:00 pm	Refreshments
Session 2	5:00 pm 5:15 pm 5:30 pm 5:45 pm	Kristin Gibbs (BIO) Karoline Ronning (POGO) Kaitlin Dailey (CHEM) Calise Berger (BIO)
Closing Remarks	6:00 pm	Dr. Jon Rienstra-Kiracofe

Following the symposium: Discussion and dinner (served at 6:15 pm) 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. Joe Alulis, Laura Burt, Leona Mirza, Jon Rienstra-Kiracofe, and Rachel Schmale. Special thanks to Provost Joseph Jones for his support and for underwriting the cost of the symposium.

Monitoring the Chicagoland Area for the Human Pathogen *Anaplasma Phagocytophilum* by PCR Amplification

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ABSTRACT

Anaplasma phagocytophilum is the cause of the disease anaplasmosis. The zoonotic pathogen A. phagocytophilum utilizes the deer tick (Ixodes scapularis) as a vector. Ticks become infected through a blood meal from an already infected host, usually a white-tailed deer or a rodent. I. scapularis, the deer tick, has a suitable habitat that covers the northern region of Illinois, including Chicago (Guerra et al., 2002). It has been hypothesized that areas of high population density can promote pathogen transfer because of increased host contact. Additionally, there might be higher rates of pathogen introduction to humans both due to smaller areas for the vector and infected blood meal to live, as well as warmer microclimates that favor the pathogen and the vector (Bradley and Altizer, 2007). A multitude of arthropod borne pathogens exist (e.g. Anaplasma spp., Babesia spp., Borellia spp.,), therefore continual surveillance for each pathogen is essential. This will provide health care workers with the proper foundation for educated diagnosis.

One of the most common tick-borne diseases in the midwestern and northeastern United States is A. phagocytophilum (Hamer et al., 2012). Both cause emerging infectious diseases among human and canine populations throughout the suitable habitat of the deer tick (Dumler et al., 2005). Many of the symptoms are very similar to influenza or the common cold; therefore, it is essential for local health professionals to know if A. phagocytophilum is present in an area's tick population when taking the patient's history and making an educated diagnosis. As the endemic ranges of parasites, vectors and hosts change with time, the continual screening for Anaplasma should be continued, despite the recent negative findings by Hamer et al. The purpose of this study is to determine if A. phagocytophilum is present in the I. scapularis population of the Chicago area.

Surveillance is carried out by gathering ticks from areas in Lake and Cook County and then processing them to harvest midgut DNA. This DNA will include the genomes of any infecting pathogens. These DNA samples are then screened through PCR amplification of a signature Anaplasma DNA sequence. Upon construction of a positive PCR control, a total of 25

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ticks have been screened for A. phagocytophilum. The organism has not been detected in any of the samples screened thus far, though further monitoring is underway. For this research to be conclusive, many more ticks must be screened. If Anaplasma were to be found in the area surrounding Chicago, health providers should be notified of the possibility for patient infection.

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Art, Chicago, and American Indian Identity

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ABSTRACT

Using a combination of secondary research and interviews with staff members at the Mitchell Museum of the American Indian, the Trickster Gallery, and several American Indian artists in Chicago, IL, this research examines the dialectic relationship between modern American Indian identity, art, and the city of Chicago. The purpose of this research is to gain greater understanding of the American Indian population in Chicago through its self-expression in visual art.

The scholarly texts and transcripts of personal interviews were coded according to similar themes in the areas of the theories associated with a sociology of art, the components of modern American Indian identity, pertinent historical events, contexts, values, and beliefs in both white and American Indian culture, and the characteristics of modern American Indian visual art.

Analysis of the gathered information indicates that modern American Indian identity is increasingly fragmented and tribal-based which is mirrored in the individualization of American Indian artists and artwork. However, these artists also use their art to overcome the challenges facing the entire American Indian community, including historically entrenched stereotypes, white culture's well-meaning nostalgia for their past, commercialization of their art, anger over past injustices perpetrated against their people, and even resistance to their self-expression on the part of their own tribes which label their art as "not Indian enough" when it is influenced by Western aesthetic traditions. Furthermore, American Indian artists are divided between older generations who seek to preserve tradition in art and a younger, experimental cohort who incorporate different messages and techniques. American Indian artists express increasingly complicated and dynamic identities in art which runs the gamut from highly traditional work to artwork influenced by modern and postmodern aesthetic trends. However, many individuals also manage to meld seemingly conflicting identities and negotiate the boundaries between them with ease. The picture painted of modern American Indian identity through visual art is highly varied, making generalization difficult. However, one thing is clear: American Indians remain proud of their Native heritage and are honored to express it through visual art.

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Total Reflection X-Ray Fluorescence Spectroscopy (TXRF): Application for Detection and Analysis of Elemental Contaminants in the North Branch of the Chicago River, by General Chemistry Laboratory Students

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ABSTRACT

This research project develops a teaching experiment which allows introductory chemistry students the opportunity to apply sophisticated Total Reflection X-Ray Fluorescence (TXRF) spectroscopy to detect elemental pollutants in the North Branch of the Chicago River. Our goal is to establish experimental protocols and methods that allow an introductory-level-student to utilize TXRF spectroscopy to detect the elemental contaminants in water samples, including the North Branch of the Chicago River. Students will first make their own solutions (Fe, Ni, Cu, etc.) of known concentration and analyze them using TXRF spectroscopy. Students will then use TXRF spectroscopy to analyze drinking water from various sources as well as water from the North Branch of the Chicago River. Through this experiment, students will experience first-hand issues of environmental pollution caused by anthropogenic effects in the Chicagoland area. Our project is one of the first in the nation to use TXRF spectroscopy in a General Chemistry laboratory setting.

Manufacturing processes, in addition to natural occurring chemicals and minerals, are sources of general public exposure to heavy metal (Pb, Hg, Cd, etc.) contaminants in water sources (1). TXRF spectroscopy is a qualitative and quantitative multi-element micro-analysis system. It is an ideal instrument for trace analysis of elemental contaminants in water and solids. TXRF spectroscopy can detect contaminants at levels of ppm and ppb (down to 0.1 ppb). TXRF spectroscopy works by bombarding sample atoms with X-rays, and detecting levels of energy from photons emitted by the sample atoms (fluorescence radiation). TXRF spectrometer is capable of detecting elements that range from sodium (Na) to uranium (U) on the periodic table. TXRF spectroscopy can be used for the detection of elemental contaminants in the North Branch of the Chicago River, for which recent studies have shown high probabilities of heavy metal pollution amongst this public water system (2).

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Bible Translation and Ethnopoetry

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ABSTRACT

The original text of the Bible in Hebrew, and the Greek of the Gospels are not written in prose, as it comes across in modern English Bible translations. They are powerful poems. Sadly modern translations erase the intent and power of this poetry.

This semester I have embarked on a journey to capture this poetic dimension of the Bible. I have sought to capture the poetry of parts of the Book of Genesis. I have done this under the guidance of Dr. Boaz Johnson. The project is based on a philosophy of translation developed by Dr. Boaz Johnson. He has translated the Hebrew poetic phrases into "raw English poetry," which seeks to preserve the poetry of the original Hebrew and Greek texts of the Bible. These "raw Hebraic poems" are then converted to Ethno-poetry in different World Christian churches. My task was to take these "raw Hebraic poems" and translate them into poetry which could be sung in the African American churches.

I am a poet. I saw this as a great opportunity to translate the Word of G-d in a creative way. I have been doing spoken word for eleven years now, since the 5th grade. My writing has evolved in a way that has caused me to move closer to G-d in worship.

There are so many ways to worship G-d and spoken word happens to be my source that I connect with Him best. When I do spoken word, I am able to connect with the hearers and this causes a new avenue for the hearer to worship as well. It is something about the emotion and passion behind spoken word that causes one to be vulnerable and transparent with the audience or the hearer.

There is poetry throughout the Bible. It is used as a mechanism to express one's self in the act of worship and in the act of lamenting. Poetry, "spoken word," is important in these manners.

The African American Church is also deeply into poetry. The preaching in the African American Church has always been poetic. Poetry and song has always been something that the African American Church has held strongly to. Since times of slavery, poetic expression and creative song have been used to bring message of the gospel as well as liberation. The Bible is full of poetry and is very poetic. I strongly feel that we should get back to the original intent of what the Bible has to offer. That is what I have set out on this journey to do and prayerfully, that is what I have done. My motive and the goal were to obtain and introduce a new way to meet G-

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d in the midst of hearing the poetry of the Word. The hope of creating an atmosphere that allows hearers to meet G-d in a creative way. We are created to create and I feel that G-d is allowing me to be creative with the Living Word.

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Effect of Non-Specific Phosphodiesterase Inhibitors on the Modulation of Levodopa-Induced Dyskinesias in Parkinsonian Rats

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ABSTRACT

Parkinson's Disease (PD) is a progressive neurogenerative disorder characterized by loss of dopaminergic neurons in the substantianigra resulting in deficits of voluntary motor movements (Dauer et al. 2003). Currently, the gold standard treatment for PD is oral administration of a drug called L-DOPA to help relieve motor impairments in PD patients. However, after 5-10 years of taking L-DOPA, patients experience a pharmacological wearing off effect and instead exhibit behaviors called L-DOPA induced dyskinesias (LID) (Steece-Collier et a. 2003). LID are marked by small, repetitive, uncontrollable movements of the neck, trunk and extremities. Patients often describe LID as debilitating as the disease itself.

In order to find more effective treatments for Parkinson's Disease, we investigated a new potential therapeutic target called phosphodiesterase (PDE). PDE is an intracellular protein that is important in cell activity and signaling. PDE is found throughout the brain, but is particularly highly localized in the cells of a region of the brain called the basal ganglia. The basal ganglia is a specialized network of cells in the brain that contributes to the production of voluntary motor movements (Kleiman et al. 2003). In LID exhibiting rats, PDE levels are significantly higher in the basal ganglia than rats without LID (Picconi et al., 2011). Therefore, in this study, we examined the effect of PDE inhibition on LID by using a drug called papaverine (PAP) (Kleiman et al. 2003).

This study was investigated using a rat model of PD that mimicked the neurodegeneration and motor deficits found in PD patients. The four treatment groups included: (1) control with vehicle, (2) PD rats with vehicle, (2) PD rats with L-DOPA, and (4) PD rats with L-DOPA and PAP. Following injections of L-DOPA and/or PAP, rats were individually placed in a clear cylindrical enclosed space to record their motor behavior for two minutes. Each rat was recorded at 20 minute intervals for a total duration of 180 minutes. The treatments were administered on days 1, 4, 9, 14, 18, and 21.

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Motor behavior of these animals was scored in order to examine the effect of PAP on LID by using a hybrid dyskinesia rating scale of two rating criteria created by Steece-Collier and Maries (Steece-Collier et al. 2003 and Maries et al. 2006). These ratings were then compared statistically to conclude the effects of each treatment combination. The specific behaviors included: neck torsion, trunk torsion, forelimb dystonia, hindlimb dystonia, left forepaw dystonia, orolingual, head bobbing, forelimb-facial stereotopy, frequency, and rotations per minute. The first five of the above listed symptoms and frequency were rated on a 0-3 scale (0 being not present and 3 being severe throughout the entire two minutes). Orolingual, head bobbing, and fore-limb facial stereotopy were rated as 0 or 1 (0 meaning not present and 1 meaning present at any point in the clip). Lastly, the rotations per minute were averaged over the two minute clip. The rats were divided by treatment for scoring and the data was compiled together for completion of statistical analysis.

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Is Al Qaeda Dead?: A Case Study of Al Qaeda Through its Branch in Yemen

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ABSTRACT

The major purpose of this project was to assess the current state and strength of Al Qaeda. Terrorism expert Fawaz Gerges claims that Al Qaeda is dead since the centralized organization has been losing power; the war with Al Qaeda should be declared over. Leah Farrall, another counterterrorism analyst, argues that the focus on the capacity of the central organization is essentially wishful thinking because it neglects the branches. The paper tests these competing claims by examining Al Qaeda's franchise in Yemen, Al Qaeda in the Arabian Peninsula (AQAP).

AQAP disproves the idea that Al Qaeda is dead since this branch continues to carry out the mission of Osama bin Laden after its foundation on his direct orders; considered the most active branch of the Al Qaeda network, bin Laden communicated with it until his last days.

Local factors in Yemen contribute to AQAP's strength. The Arab Spring in early 2011 caused a transition in government in Yemen and the new President Hadi has little support outside of Sanaa, the capital, in the areas where Al Qaeda predominantly operates.

The different branches of Al Qaeda, like AQAP, are providing life for Al Qaeda Central (AQC). AQC was obviously weakened when Seal Team Six killed bin Laden May 2, 2011. But the continued success of the branches in promoting jihad on a global scale against the West gives AQC time to reassert its authority.

The findings suggest that Al Qaeda is definitely not dead, even if the central organization appears to be. It may perhaps be that Al Qaeda Central is in a transitional period, where they have to pull back in order to gain strength and assert their authority over their branches once again.

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Recycling of Plastics: Integrating Service Learning and Green Chemistry in the Organic Chemistry Curriculum at North Park University

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ABSTRACT

The everyday use of plastics in society presents an excellent opportunity to demonstrate the important role of chemistry in society. The increased awareness of environmental issues also provides an incentive to introduce students to the relevance of green (sustainable) technologies The rapid development of plastics like polyethylene terephthalate (PET or PETE), used in consumer packaging products such as water and soft drink bottles (labeled as *Plastic 1*) inevitably contributes several billion pounds of waste to landfills every year.[1] According to the 2011 United States National Postconsumer Plastics bottle recycling Report by the American Chemistry Council and the Association of Postconsumer Plastic Recyclers, of the 5.5 billion pounds of PET bottles produced, only 1.6 billion (29.3%) was recycled[1]. Thus, recycling of PET has recently attracted enormous attention to promote effective use of limited fossil resources to mitigate impacts on solid waste.

To connect students' laboratory experience with "real-world" problems, while learning the concepts of esterification and transesterification, our research group conceived a project based on the recycling of two plastics: PET and the new, modern biodegradable material, polylactide (PLA).[2] Although a handful of recent publications[3,4,5] have addressed this academic endeavor, their experiments involve conditions that are untenable in regular undergraduate settings, like the use of super anhydrous materials, expensive catalysts, or extremely long reaction periods at high temperatures. This research consists of designing and developing a high yielding, mild chemical procedure to depolymerize PET. Our approach focuses on adaptation to a 3 hour lab period and the use of microwave heating as a tool for sustainable chemistry. In addition, the effect of different catalysts, concentrations, and temperatures are taken into consideration. In much the same manner, this lab strives to contrive a method to recycle PLA. Upon the success of this research, not only will the procedure become integrated into the Organic Chemistry curriculum, but it will be published as a more efficient way to depolymerize (or 'recycle') these particular plastics at small scale.

This project was designed to include a service learning component, with North Park as our community partner.

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Screening for the presence of *Babesia* species within Cook and Lake County

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ABSTRACT

Babesiosis is widely recognized as an emerging zoonosis, a disease transmitted by animals to humans. The most common areas of transmission in the United States are the Northeast and upper Midwest (Barbara, 2011). Although many species of *Babesia* are causative agents of babesiosis in mammals, few species are known to infect humans. The most common causative agent of babesiosis in humans in North America is *Babesia microti* (Schnittger, 2012). *B. microti* is a parasitic protozoan that is transmitted to humans through the bite of an infected *Ixodes scapularis* tick, commonly referred to as the deer tick. Part of the life cycle of *I. scapularis* requires a blood meal from a mammalian host (which can include humans), so individuals who live in areas that are known to support *I. scapularis* are at risk for being infected with *B. microti*. *B. microti* is known to have a low infection rate and has only been identified within the Midwest in the past thirty years (Steketee, 1985). Recent identification of *Babesia* in the Midwest has been limited to individual clinical presentations resulting in death (Berman, 2009) (Froberg, 2008). The purpose of this study is to establish if *Babesia* species are present in the Chicagoland area through the careful PCR screening of extracted *I. scapularis* tick mid-guts.

Adult *I. scapularis* ticks were collected from two collection sites. Each site was part of either the Lake County Forest Preserve, between 20 and 30 miles north of Chicago and the Cook County Forest Preserve, 10 miles west of Chicago. *I. scapularis* tick mid-guts were extracted aseptically. Genomic DNA was isolated from these midguts through the use of a Qiagen DNeasy Blood and Tissue Kit. Screening for *B. microti* was accomplished using a standard PCR protocol to amplify DNA. The *Babesia* species was identified through sequencing the DNA and cross-referencing the data with known DNA sequences.

205 samples of extracted genomic DNA from *I. scapularis* ticks were screened. Of the 205 samples, 4 samples indicated the presence of *Babesia*. This translates to a 1.9% infection rate within the *Ixodes scapularis* population. Through sequence data, the presence of *Babesia* was confirmed and all isolates was determined to be *B. odocoilei*.

This confirms the presence of *Babesia* within Cook/Lake County. Although *Babesia odocoilei* is not a known infective agent in the human population, it has demonstrated pathogenicity in the cervidae family, with the potential for fatal cases in this population (Schoelkopf, 2005). This puts white-tailed deer, elk, and reindeer at risk, which could be of particular concern to zoos and farms within areas surrounding Cook and Lake County. Due to the

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apparent expansion of the pathogens geographical range and the potential severity of *babesiosis*, it is important to continue to monitor the progression of *Babesia* species present in Cook and Lake County.

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