

8TH ANNUAL NORTH PARK UNIVERSITY UNDERGRADUATE RESEARCH SYMPOSIUM

TUESDAY, APRIL 29, 2014

BRANDEL LIBRARY, NORTH PARK UNIVERSITY

CHICAGO, ILLINOIS

PROGRAM

Event	Time	2 nd Floor Gallery	3 rd Floor Gallery
Welcome	3:30 pm	Professor Ilsup Ahn	Professor Peggy Kotowski
Student Presentations	3:40 pm 4:00 pm	Nick Weinstein (BIO) Kathryn Larson (BTS)	Katelynn Laures (BTS) Ngan Ngo (CHEM)
Refreshments	4:20pm	2 nd Floor Gallery	
Student Presentations	4:40 pm 5:00 pm 5:20 pm	Allison Hoden (PSYC) Kristin Gibbs (CHEM) Emmy Mosburg (BTS)	Caroline Mjølnes (BIO) Gwen Muñoz-Arroyo (PSYC)
Closing Remarks		Professor Ilsup Ahn	Professor Peggy Kotowski

Following the symposium: Discussion and dinner (served at 6:00 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. Ilsup Ahn, Joe Alulis, Margaret Kotowski, Ter-Yun Lin, Leona Mirza, Jon Rienstra-Kiracofe, Rachel Schmale, and Sarah Thorngate. Special thanks to Provost Jones for his support and for underwriting the cost of the symposium.

SYNTHESIS OF ALPHA-HYDRAZINO ESTERS

Kristin Gibbs¹
North Park University

Isabel Larraza, Ph.D.
Chemistry Department, North Park University

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

¹ Presenter and corresponding author. Email: kgibbs@northpark.edu

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.

This project was funded by the 2012 IDPG grant entitled “USING NORTH PARK’S NEW MICROWAVE REACTOR IN THE TEACHING AND RESEARCH LABORATORIES”

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1. Some examples: a) Imming, P; Sinning, C.; Meyer, A. *Nat. Rev. Drug Discovery* **2006**, *5*, 821
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COPING WITH ANXIETY: THE EFFECTS OF RELIGIOUS COPING ON THE SPIRITUAL AND SUBJECTIVE WELL-BEING OF COLLEGE STUDENTS

Allison Hoden²
North Park University

Elizabeth K. Gray, Ph.D.
Psychology Department, North Park University

ABSTRACT

The purpose of this study is to explore the association between college students' subjective and spiritual well-being and their general and religious methods of coping with high-anxiety life events. Research exploring the physical and psychological effects of religion and spirituality has grown substantially over the past decade as religiosity was found to have physical and mental health benefits. A branch of scientific religious research has focused on its application to coping with anxiety and stress and the effect on well-being (e.g. Myers, 2008; Pargament, 2002; Wong-McDonald & Gorsuch, 2004).

The college experience has become synonymous with the psychological concept of “emerging adulthood”—the developmental stage between adolescence and early adulthood (Arnett, 2000). This phase is marked by growth and discovery of one's identity and worldview. Emerging adults may explore or reexamine their religious and spiritual beliefs and practices. This study compares the use of positive and negative forms of general and religious coping with stressors characteristic of emerging adulthood in a university setting.

The sample consisted of 120 undergraduate students at North Park University who were invited to participate. Ages ranged from 18 to 30 ($M = 20.38$). In response to an open-ended item regarding religious affiliation, 60 percent identified as Christian or with a Protestant denomination, 18.33 percent identified as Catholic, and 5.83 percent identified with a different faith tradition. Participants completed five self-report questionnaires via SurveyMonkey in small group sessions. Positive and negative forms of religious coping were measured through the 14-item Brief RCOPE (Pargament, Feuille, & Burdzy, 2011). Positive religious coping assesses individuals' tendencies to seek God's love, help, care, and connection in times of stress. Negative religious coping includes perceptions of God as a punisher, demonic appraisals, and a lack of support from a faith community. Methods of general coping were measured with the 28-item Brief COPE (Carver, 1997). The effects of these ways of coping with anxiety and overall subjective and spiritual well-being were measured by the State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983), the Satisfaction with Life Scale

² Presenter and corresponding author. Email: ahoden@northpark.edu

(Diener, Emmons, Larsen, & Griffin, 1985), and the Spiritual Well-Being Scale (SWB; Paloutzian & Ellison, 1982).

The results of this study are still being interpreted, but my initial statistical analysis of the data provided partial support for my hypotheses. Positive religious coping was significantly and positively correlated with the religious well-being subscale (well-being of spiritual life in relation to God) of SWB, more so than any of the general forms of coping assessed by the Brief COPE. Negative religious coping was significantly negatively correlated with the existential well-being subscale (level of adjustment to self, community, and surroundings) of SWB, more so than any other method of coping. Negative religious coping was also negatively correlated with Satisfaction with Life.

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DIETRICH BONHOEFFER, THE EVANGELICAL COVENANT CHURCH, AND NORTH PARK UNIVERSITY

Kathryn Larson³
North Park University

R. Boaz Johnson, Ph.D.
Biblical and Theological Studies Department, North Park University

ABSTRACT

The life and theology of Dietrich Bonhoeffer has proven to be inspirational, compelling, and exemplary for many who have had connections to the Evangelical Covenant Church, and it continues to be relevant for the church in the 21st century. In analyzing the theology and example of Bonhoeffer, many scholars, theologians, and ministers connected to the Covenant Church have come to interpret and adopt many of Bonhoeffer's ideas on social justice, education, Christian leadership, and how the church is to reach out to the post-modern world. These interpretations carry an evangelical and ecumenical message relevant to the ECC, and to the wider church community of our current age.

As a pastor and theologian during the time of the Nazis in Germany, Dietrich Bonhoeffer felt an incredible responsibility as a Christian and man of the church to resist Hitler's regime in whatever form he could. From his theological writings, to running an underground seminary, to his work as a double agent, Dietrich Bonhoeffer did his utmost to combat the evil facing his time, to live "fully in the world" with all of its risks, and to live a life according to the Gospel and mission of Christ. Bonhoeffer's actions in life and his works such as *The Cost of Discipleship*, *Letters and Papers From Prison*, and *Ethics* give valuable insight into his theology, and bring forward challenges and issues that face the church in "a world come of age." Scholars and theologians such as F. Burton Nelson, Geoffrey B. Kelly, and Keith Clements testify to the relevancy of Bonhoeffer's message in their works, and show how this theology can be applied to various aspects of the ECC – from individual, to local, and even to global capacities.

My research in Bonhoeffer and the Evangelical Covenant Church's engagement with Bonhoeffer shows that he is perhaps the best model of doing theology in the context of a Christian liberal arts university like North Park. This is especially true in the context of fresh challenges global society faces today- not dissimilar to the challenges Bonhoeffer faced in his Nazi context.

³ Presenter and corresponding author. Email: klarson2@northpark.edu

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EVE AS PORTRAYED THROUGH ART: AN EMPHASIS ON THE BIBLICAL AND CULTURAL INFLUENCE AND THE IMPLICATIONS FOR WOMEN

Katelynn Laures⁴
North Park University

R. Boaz Johnson, Ph.D.
Biblical and Theological Studies Department, North Park University

ABSTRACT

Art has influenced and has been influenced by the world of biblical and theological studies for thousands of years. Art is used to express deep emotion, radical opposition, passionate worship, cultural status, and so on. Theologians have consistently turned to art of many forms to interpret the Bible and to express theology. Art portraying some sort of Jewish-Christian Biblical theology has arguably been present since the 3rd and 4th centuries, with some of the earliest documented Biblical-themed art being found in the Roman catacombs.

This research project examines the interpretation of Eve in art throughout time and across various cultures. It examines how such a portrayal of Eve in art has affected, and been affected by culture. I believe this is a crucial area of study because generally Eve has been portrayed as a cultural symbol for evil within the human condition throughout time. She has stood both as a representation and example of how women understand themselves, and how culture understands the role of women, both within and outside the church.

Dorothee Sölle, in her book, *Great Women of the Bible in Art and Literature*, provides a thorough overview of many significant pieces of art that feature prominent women of the Bible. Sölle's work has undoubtedly proved a shift in how Eve has been portrayed throughout time and across culture. This research builds on Sölle's work by carefully examining the cultural climate of the time in which the art was created. Particular interest is given to the state of the church, at a particular period of time, and its relationship to culture.

My research shows the interpretation of Eve in Art has had crucial influences on the spiritual lives of women throughout the history of the Church. The way Eve has been portrayed in art has had much influence on the way women have viewed themselves, and their role in the Church. It has become clear to me that because various interpretations and art pieces about the story of Eve portray Eve as a devious and weak woman, culture at large has adopted such a view of women (Clanton 25). This conclusion has greatly influenced not only the ways in which women perceive themselves, but also the role of women in the church throughout history.

⁴ Presenter and corresponding author. Email: kmlaures@northpark.edu

The findings of this research bring together three fields of studies in my liberal arts education- Biblical and Theological Studies, Art, and History. My research shows the character of Eve has been incorporated into worship and liturgical life throughout the history of the Church. A profound example is the interpretation of Eve in Byzantine Iconography. The interpretation of Eve, through Art, continues to influence the Church even today in profound and phenomenological ways, and will continue to do so in the future.

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MULTI-LOCUS SEQUENCE TYPING (MLST) OF HOUSEKEEPING GENES TO DETERMINE PHYLOGENY OF *BORRELIA BURGdorFERI* IN ILLINOIS

Caroline Skar Mjones⁵
North Park University

Drew Rholl, Ph.D. and Matthew Schau, Ph.D.
Biology Department, North Park University

ABSTRACT

Lyme disease is caused by the spirochete *Borrelia burgdorferi* sensu stricto and is the most common vector-borne disease in the United States and Europe (Wormser et al., 2006; Steer et al., 2004). A vector-borne disease is any infectious disease that is transmitted between hosts by a different species, such as mosquitoes and ticks. *B. burgdorferi* is transmitted through *Ixodes scapularis*, which serves as the intermediate host and are vertebrate reservoir (Diuk-Wasser et al., 2012). Humans are accidental hosts and are not involved in the life cycle of *B. burgdorferi* (Steer et al., 2004). Humans that are infected with *B. burgdorferi* will, in most cases, develop skin lesion called erythema migrans, which is a red rash resembling a bull's eye (Wormser et al., 2006). In certain cases untreated patients can develop neurological and cardiac complications. When infected with a strain of *B. burgdorferi* it is important to get treatment at an early stage to avoid complications (Postic et al., 2007). Multi-locus sequence typing (MLST) is a technique used to characterize intraspecific strain relationships (Enright and Spratt, 1998; Maiden et al., 1998). Using MLST characterizes strains based on the nucleotide sequence of specific genes. MLST uses housekeeping genes for analysis because they are subject to slow evolution (Tim et al., 1999). MLST was used to characterize strains from Illinois. The purpose of the study is to establish MLST sequence types strains of *Borrelia burgdorferi* sensu stricto in the Chicagoland area.

Ticks were collected from the field and the spirochete was extracted from tick midguts and grown in BSK liquid media. Polymerase Chain Reaction (PCR) was used to amplify eight different genes by nested PCR, which is performed in two cycles. First a primer set is used in traditional PCR reaction, where one locus is amplified. Then a second set of primers is used on the product of the first PCR reaction. This increase sensitivity and specificity. The DNA was purified and sent for sequencing at the University of Chicago. Sequence for each read and gene were prepared and uploaded to the online MLST database in order to compare them to known sequences. From the combined data a strain sequence type will be established.

⁵ Presenter and corresponding author. Email: csmjones@vikings.northpark.edu

A set of tick isolates from eight different sites in the Chicagoland area was used for analysis. The research is ongoing and the current data is incomplete, but some loci have been typed. For two of the samples there has been some difficulty with the PCR amplification and purification. Two of the ticks contained a double infection making it nearly impossible to determine specific allele for the different housekeeping genes. These samples cannot be included.

Our current data suggest new sequence types in Chicago. Through the data obtained in the research it is possible to determine the dispersal pattern of different strains *B. burgdorferi* in conjugation with previously known patterns. This provides a clearer genetic landscape of the bacterium in Illinois to the rest of North America. The research is important because Lyme disease is emerging in the Chicagoland area and increased awareness in physicians will facilitate proper diagnosis.

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CHRISTOLOGY AND CULTURE: FEMINIST THEOLOGIES FROM GHANA AND BRAZIL

Emmy Mosburg⁶
North Park University

Mary Veeneman Ph.D.
Biblical and Theological Studies Department, North Park University

ABSTRACT

The purpose of this research project is to point to the importance of local theology when making decisions about the personhood of Christ. This essay is part of a larger Global Studies capstone project, but for the symposium the essay is a focused part of the larger analysis. Research for this essay is collected from published works written by scholars working in the area of local theology. Local theology according to Robert J. Schreiter, is defined as a theological perspective which does not try to apply “received theology” to a local context, but instead begins with viewing the context of a place first, to then arrive at a theological understanding. Similarly, Clemens Sedmark defines local theology as a theological understanding birthed out of a particular context and within a particular social situation. This understanding of local theology shapes the framework of analysis for this essay.

The research essay first discusses the locality of decisions surrounding Christ’s nature, at the Council at Nicaea held during year 325 and the Council of Chalcedon held during year 451. Decisions from these two councils have largely shaped a dominant interpretation of the character and personhood of Christ. Yet, local theologians challenge the notion that these historically important decisions were formed through a lens absent of cultural bias, and therefore can be applied as directly relevant to all Christians regardless of their social situation. Local theologians argue that Christological understanding cannot be separated from one’s cultural situation. They also challenge the notion that the interpretation of Christ’s nature must be limited to the decisions made at these two councils.

In order to demonstrate this point clearly, the essay emphasizes the Christological findings of two feminist theologians. One local theologian discussed is Mercy Amba Oduyoye from Ghana and the other is Ivone Gebara from Brazil. Gebara and Oduyoye have interpreted the personhood of Christ from their own social location, as women theologians in Brazil and Ghana. The essay address their theological discoveries about Christ’s nature from their own cultural and social locations, and then compares and contrasts these interpretations with the elements of Christ’s nature determined at the Council of Chalcedon and Council Nicaea. Various aspects of

⁶ Presenter and corresponding author. Email: emmysosburg@gmail.com

Christ's nature determined at the two Council's are incongruent and even oppressive to the local experience of Christianity for Oduyoye and Gebara. These differences in the understanding of the personhood of Christ therefore emphasize the value in understanding local theologies, when determining Christology.

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THE JOINT RELATIONS BETWEEN HOARDING SYMPTOMS, ANXIETY SENSITIVITY, PERSONALITY, AND ROOMMATE RELATIONSHIP SATISFACTION

Gwendolynn Munoz-Arroyo⁷
North Park University

Elizabeth K. Gray, Ph.D.
Psychology Department, North Park University

ABSTRACT

The purpose of this study is to better understand the joint relations between hoarding behaviors in a non-clinical population, anxiety sensitivity (the fear of fear), personality, and roommate relationship satisfaction. In small group sessions, 120 participants, primarily students in psychology courses, completed self-report measures including: the SI-R (Frost, 2001) measuring hoarding; the DOCS (Abramowitz, 2009) measuring obsessive-compulsive behaviors; the ASI (Reiss, Peterson, Gursky, & McNally, 1986) measuring anxiety sensitivity; the BFI (John & Srivastva, 1999) measuring personality traits; and the Relationship Assessment Scale (Hendrick, 1988) measuring relationship satisfaction.

Until recently, hoarding was considered a symptom of Obsessive-Compulsive Disorder (OCD), but hoarding became a disorder in 2013 in the Diagnostic and Statistical Manual of Mental Disorders 5th edition. Because hoarding is a new disorder, there has not been much research on hoarding alone since it has usually been grouped into OCD. On its own, hoarding can cause severe distress and impairment in various aspects of people's lives--in people's health and relationships especially (Steketee & Frost, 2003).

Coles, Frost, Heimberg, and Steketee (2003) completed a study that shows a strong relationship between hoarding behaviors and anxiety sensitivity exists, but not much research has been completed on this relation. Since most college students are on their own for the first time, they have more independence, so they can choose whether to discard items and whether to acquire items. Most college students also live with roommates, but college roommates' relationships are significantly different than relationships between someone who hoards and their significant other, family, or friend, because college roommates sometimes, especially during freshman year, do not get the liberty to choose their roommate or to switch roommates easily. However, the relation between hoarding behaviors and relationship satisfaction has not been investigated nor has the relation between anxiety sensitivity and relationship satisfaction been investigated. In a study conducted by Abbey, Clopton, and Humphreys (2007), researchers found that OCD was negatively correlated with romantic relationship satisfaction.

⁷ Presenter and corresponding author. Email: gwenmunozarroyo@gmail.com

Knowing that hoarding strongly, positively correlates with anxiety sensitivity and that OCD is negatively correlated with romantic relationship satisfaction, I hypothesize that anxiety sensitivity and relationship satisfaction will be strongly, positively correlated and that hoarding behaviors and relationship satisfaction will be negatively correlated.

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MECHANISM OF THE INTERACTION BETWEEN ALKYLPHENOLS AND HUMIC SUBSTANCES

Ngan Ngo⁸
North Park University

Anne Vázquez, Ph.D.
Chemistry Department, North Park University

Francisco Vázquez, Ph.D.
Department of Chemistry, University of Illinois at Chicago

ABSTRACT

In the increasingly industrialized world, waste is sometimes discharged into the environment. One type of industrial waste is long-chain alkylphenols. Alkylphenols are used in many industrial applications, including the production of phenolic resins, a type of plastic.¹ Long-chain alkylphenols, such as 4-octylphenol (Figure 1) are known to be weak endocrine disruptors. Endocrine disruptors are hormone-like substances that disrupt the normal endocrine functions in animals and humans.^{1,2} Because of the potential dangers of alkylphenols in the environment, it is necessary to understand how these compounds interact with soil. From studies conducted by other research groups, it is known that long-chain alkylphenols, such as 4-octylphenol, bind to humic acid, a major organic component of soil (Figure 2). However, the binding mechanism is unknown.³⁻⁷ The goal of this study is to understand the binding mechanism between alkylphenols and humic acid. Using vibrational spectroscopy, we are studying the interaction between humic acid and alkylphenols with different chains to determine which part of alkylphenols interact with humic acid. In addition, molecular dynamics computer simulations of humic acid⁸⁻¹⁰ and alkylphenols are being conducted with Dr. Francisco Vázquez at the University of Illinois at Chicago to get a molecular-level picture of the interactions and to help verify our spectroscopy results.

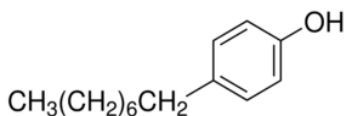


Figure 1. Chemical structure of 4-octylphenol³

⁸ Presenter and corresponding author. Email: nngo1@northpark.edu

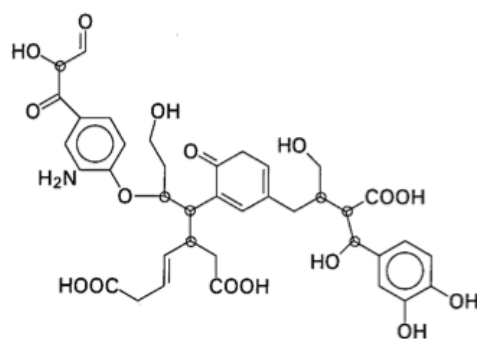


Figure 2. Representative structure of humic acid monomer unit⁸

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SCREENING FOR THE PRESENCE OF *BORRELIA BURGENDORFERI* IN IOWA ISOLATES

Nick Weinstein⁹
North Park University

Drew Rholl, Ph.D. and Matthew Schau, Ph.D.
Biology Department, North Park University

Joshua Nelson
Luther College

ABSTRACT

Borrelia burgdorferi sensu stricto is a spirochete bacterium most known for causing Lyme disease. The Center for Disease Control reports more than 20,000 cases each year in the United States. However, over 95% of cases were reported in 13 states, suggesting specific factors needed for the disease to be transmitted to humans (CDC, 2012). While there is a large amount of information on this bacterium in the upper Midwest, data in Iowa is based on passive screening of the vector (the deer tick, *Ixodes scapularis*) for the organism. Polymerase chain reaction (PCR) was used to analyze the genes for the outer surface proteins C and A from *Borrelia* isolates collected in Decorah, Iowa. The goal of this research is to develop an infection rate of ticks in Decorah, Iowa, and the surrounding area.

The presence of *Borrelia* was confirmed by amplifying the genes for outer surface protein C (*ospC*) and the outer surface protein A (*ospA*) using PCR as developed by Bunikis, et al. To begin the screening process we cultured the midgut of ticks in a BSK media to grow the *Borrelia* species. The organisms were identified using dark light microscopy. The DNA from positive samples was purified and sent to the University of Chicago for sequencing. The *ospA* sequences are used to predict pathogenicity in ticks; the *ospC* sequences are used to predict it in humans. Results from sequencing were compared to online databases using a basic local alignment search tool (BLAST). Alignment and percent homology was used to determine the species and strain types of each sample.

We have confirmed the presence of *Borrelia burgdorferi* sensu stricto in tick isolates from the Decorah, Iowa area. Of the 173 ticks tested, 37 carried *B. burgdorferi*. DNA from the positive samples was isolated for further analysis. Four samples analyzed were positive for *Borrelia* DNA during PCR. This was further confirmed when they were analyzed using the *ospC* sequence as well as the *ospA* sequence data. These strains had a 99% sequence homology

⁹ Presenter and corresponding author. Email: nrweinstein@vikings.northpark.edu

to the *ospC* allele of the B31 strain of *B. burgdorferi*, an isolate known to be pathogenic in humans.

While this research is still not complete, our findings thus far suggest that isolates of *Borrelia* we collected from this region of Iowa are *Borrelia burgdorferi* sensu stricto and may contribute to the increase in Lyme disease patients in Iowa. Our findings could have direct impacts on health care protocol in the Decorah, Iowa area. Our data is similar to a study measuring the percentage of *Ixodes scapularis* carrying *B. burgdorferi* sensu stricto in Northeastern Iowa. According to the study *B. burgdorferi* has increased from below a 10% infection rate in 1998 to a high of 36.6% in 2002 (Lingren et al., 2005). This increase in the infection rate in the tick population in the area would suggest a need to reform the health care currently provided regarding prevention of Lyme disease in the area because of the potential for undiagnosed or untreated Lyme disease becoming fatal is cause for concern.

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