Hope College Digital Commons @ Hope College

11th Annual Celebration for Undergraduate	Celebration for Undergraduate Research and
Research and Creative Performance (2012)	Creative Performance

4-13-2012

Hope College Abstracts: 11th Annual Celebration of Undergraduate Research and Creative Performance

Hope College

Follow this and additional works at: http://digitalcommons.hope.edu/curcp_11

Recommended Citation

Repository citation: Hope College, "Hope College Abstracts: 11th Annual Celebration of Undergraduate Research and Creative Performance" (2012). 11th Annual Celebration for Undergraduate Research and Creative Performance (2012). Paper 207. http://digitalcommons.hope.edu/curcp_11/207 April 13, 2012.

This Book is brought to you for free and open access by the Celebration for Undergraduate Research and Creative Performance at Digital Commons @ Hope College. It has been accepted for inclusion in 11th Annual Celebration for Undergraduate Research and Creative Performance (2012) by an authorized administrator of Digital Commons @ Hope College. For more information, please contact digitalcommons@hope.edu.

TABLE OF CONTENTS

Letter from the Provost Presenters

ARTS & HUMANITIES

- I Dance
- **3** Modern & Classical Languages
- **6** History
- 11 Music

INTERDISCIPLINARY

- 12 Interdisciplinary
- 14 Mellon Scholars
- **22** Phelps Scholar

NATURAL & APPLIED SCIENCES

- 24 Biochemistry
- 26 Biology
- 35 Chemistry
- **51** Computer Science
- **53** Engineering
- **58** Geological & Environmental Science
- **60** Mathematics
- 62 Neuroscience
- **68** Nursing
- **74** Physics

SOCIAL SCIENCES

- **80** Communication
- **81** Economics, Management & Accounting
- **82** Education
- **84** Kinesiology
- 91 Psychology
- **99** Sociology & Social Work



LETTER FROM THE PROVOST

April 13, 2012

DEAR FRIENDS,

Welcome to the Eleventh Annual Celebration of Undergraduate Research and Creative Performance at Hope College. This event provides a signature lens into the kind of learning that makes Hope College distinctive among its peers—learning by doing. The booklet in your hands and the posters you will study in the DeVos Fieldhouse are the culmination of the work of hundreds of Hope College students and their faculty partners. Each project represents a collaboration between the present and the next generation of scholars—a teamed effort that brings the classroom to life and inspires the kind of learning that lasts a lifetime.

The breadth, depth, and quality of student-faculty collaborative scholarship at Hope College is something that can be hard to explain to those who do not know the college well. I frequently provide visitors with this book of abstracts as one way to help them understand how Hope is different from other colleges and universities in this regard. The book of abstracts is only one slice of a much larger effort aimed at helping students develop the knowledge, skill, and identity required for high quality scholarly enterprise. There is much more collaborative research taking place than can be found between the covers of this book!

The projects you'll see at the Celebration are the product of countless hours of work by students, faculty and staff. To each student who labored in the lab or library congratulations. To each professor who chose to work on a research project with a student instead of pursuing other avenues of scholarly activity—thank you. For each staff member who planned this event, prepared the abstract book, made the arrangements, and generally pitched in to help highlight a true distinctive of a Hope College education—you have my gratitude.

If you are interested in knowing more about the distinctive qualities of a Hope College education, including learning by doing, please visit www.hope.edu. Thank you for your participation in this Celebration. I am confident that you will learn much about our students and professors and their nearly limitless capacity for creativity.

Sincerely,

had Ray

Richard Ray Provost

- **6** Joseph Adamson
- 37,43 Kyle Alexander
 - **45** Jesse Alvarado
 - 3,16 Athina Alvarez
 - 41 Dan Anderson
- 84,86 Emilee Anderson
 - 15 Tessa Angell
 - 87 Sarah Antrobus
 - **55** Lauren Aprill
 - 38 Angela Aumaugher
 - **93** Nathan Axdorff
 - 16 Elizabeth Badovinac
 - 8 Anne Baenziger
 - **44** Alexa Bakker
 - 86 Kristine Baldwin
 - 12 Katelyn Barry
 - 71 Cara Bartels
 - **39** Casey Baxter
 - **67** Lydia Baxter-Potter
 - **91** Evan Beals
- 39,40 Christopher Beaudoin
 - **23** Haley Beck
 - 87 Kristina Bectel
 - 16 Anthony Bednarz
 - 67 Sharina-Mae Bello
 - **41** Bailey Bensley
- 39,40 Alexandra Benson
 - **41** Zachary Beswick
 - 70 Caleb Billman
 - 26 Elizabeth Billquist
 - **77** Michael Bischak

- 50 Derek Blok
- 100 David Blystra
- 86 Colton Bodrie
- Generation Generatio Generation Generation Generation Generation Generatio
- 100 Lindsey Boeve
- **83** Kristen Bosch
- 40 James Bour
- **84** Paul Bowen
- **35** Michael Bowerman
- **63** Mary Bradley
- **71** Abby Branderhorst
- 41 Kyle Brubaker
- 56 Katherine Brune
- 87,88 Kurt Buchholz
 - **28** Hilary Bultman
 - **2** Ashley Burns
 - 17 Katherine Callam
 - **57** Christian Calyore
- 92,96,98 Jacqueline Canonaco
 - Ariana Cappuccitti
 - **57** Elena Caruthers
 - 92,97 Gabriel Casher
 - 42 Alyssa Cassabaum
 - Rachel Cho
 - 29,30 Sarah Colton
 - 13 Jillian Conner
 - 41,42 Andrew Cook
 - 30 Erika Coombs
 - 29 Jeff Corajad
 - 92,97 Ryan Cotter
 - 82 Kristen Craig

STUDENT PRESENTERS

63 Cassondra Cramer
70 Sean Cratty
42 Rebecca Danforth
20,04 Chris Davis
12 Alexandra Day
32 Zachary DeBruine
70 Tracy DeKoekkoek
33 James DelBene
67 Andrea Dimet
42 Howard Dobbs
62 Andrew Dolehanty
38 Rachel Doud
Allyson Dreger
93 Ashley Drew
28 Jamin Dreyer
64 Erika Dvorak
92,97 Sara Dykstra
37 Elly Earlywine
72 Alexandra Egedy
27 Maria Eguiluz
77 Matthew Eiles
39,40,43 Meagan Elinski
83 Rachel Elzinga
80 Salome Emmanuel
45 Thomas Endean
88 Amanda Engbers
58,59 Nathan Erber
81 Emily Evans
18 Lauren Ezzo
67,93 Liz Fast
80 Jesse Fazi

- 48 Amanda Ferguson
- 83 Anna Filcik
- 99 Samuel Fishman
- **6** Emily Fleming
- 26,64 Guillermo Flores
 - 17 Kayleigh Forlow
 - 50 Johanna Forst
- 92,97 Ann Frisella
 - 27 Mitchell Gage
 - 89 Lauren Gaines
- 30,32 Sara Gallemore
 - 2 Helen Gay
- 63,65 Anne Georges
 - **44** Amanda Gernentz
 - 30 Elizabeth Gerometta
 - 18 Bill Getschman
 - **42** Christine Gobrogge
 - 31 Danielle Goodman
 - 89 Cory Gowman
 - **78** Nathan Graber
 - 25 Tessa Grabinski
 - **72** Amber Graeser
 - 28 Claudio Gratton
 - 40 Jacob Green
 - **43** Matthew Gregory
 - 61 Eric Greve
 - **38** Jamie Grit
 - 23 Bryce Groshek
 - 25 David Grossens
 - **31** Rachel Haas
 - **25** Joe Habbouche

- **53** Phillip Hallam
- **64** Michael Harper
- **80** Jasmine Harris
- 65 Matt Hartwell
- 86 Chris Harwood
- **59** Kristen Hasbrouck
- 61,83 Nicholas Haugen
- 92,97 Kelsey Hawkins
 - **5**1 Nicholas Hazekamp
 - **58** Dean Hazle
 - **88** Valerie Headley
 - **27** Eric Hederstedt
 - 7 Jeffrey Helm
 - 3 Katelyn Hemmeke
 - **5** Michael Henley
 - 99 Matt Herm
 - **22** Miriam Hernandez
 - 22 Ann Hersey
 - **50** Benjamin Hicks
 - **62** Elizabeth Hidlebaugh
 - **70** Elizabeth Higginbotham
- 26,66 Erin Hildebrandt
 - **98** Kukua Hinson
 - 28 David Hoekman
 - 27 Krista Hoevemeyer
 - 27 Cameron Holder
 - **89** Ryan Holmes
 - 18 Kaitlyn Holmwood
 - **29** Austin Homkes
 - 27 Kayli Horne
 - 41,50 XiSen Hou

- **38** Andrea Houg
- 54,78 Nick Hubley
 - **22** Matthew Hughes
 - **38** Eric Hydorn
 - 85 Allison Isham
 - 100 Anne Jamieson
 - 32 Erica Jansen
 - **6** Jacob Jeffers
 - II Erin Johnson
 - **51** Matthew Johnson
 - **23** Christopher Jones
 - 86 Zachariah Jones
 - 19 Tessa Judge
 - 51 Joshua Kammeraad
 - 51 Joshua Kamstra
 - **73** Andrea Karnik
 - **7** Matthew Keller
 - 64 John Kemink
 - ³ Katherine Kirby
 - **44** Annalise Klein
 - 78 TJ Klein
 - 55 Laine Klopfenstein
 - 79 Kyla Koboski
 - 26 Jessica Kozack
 - 85 Dan Kraakevik
 - **9** Alexander Krieg
 - 33 Kelly Krueger
 - 81 Chris Kunnen
- 58,60 Leah LaBarge
 - 8 Cory Lakatos
 - 99 Trevor Lake

STUDENT PRESENTERS

(olo Amanda Lavman	A Lauron Millon
Alizza Lashara	73 Esther Maar
Allson Lechner	+> Esther Moon
²⁵ Allison Leigon	G7 Keisey Moore
42 Bryan Leland	25 Osiris Morel
52 Timothy Lewis	87 Lusa Mosher
82 Sarah Lidgard	60 Connor Mulcahy
52 Hsiang Lin	45 Brian Mulhern
30,32 Abigail Lindberg	۵۵ Aja Nash
64 Jacqueline Logan	84 Logan Neil
27 Lize Loubser	22 Heather Nicholson
75 Eric Lunderberg	94 Amanda Norris
40 J. Patrick Lutz	27 Nicholas North
96,98 Chelsea Lynch	19 Madalyn Northuis
19 Lauren Madison	84 Amanda Norton
45 Adam Maley	41 Dave Nowicki
33 Marissa Martz	27 Heather O'Connell
9 Felicia Mata	🖌 Julie Oosterink
27 Andrea Matthew	42 Arcelia Ortega
72 Angelina Matthews	15 Daniel Owens
84 Emery Max	84 Kylie Padgett
26 Sheri McCormack	97 Rebecca Palmitier
79 Andrew McCubbin	20 Amanda Palomino
II Caitlin McDougall	6 7 Michael Parrish
62 Kyle Mckey	25 Katie Partyka
27 Lisa McLellan	42 David Paul
∽4 Mara McMurray	25 Jacqueline Peacock
27 Seth Menzer	83 Samuel Pederson
35 Andrew Mepham	20 Hailey Perecki
27 Danielle Mever	94,96 Kirsten Peterson
12 Araksva Mikaelvan	78 Kellv Petraskv
93 Elizabeth Miller	38 Nick Pikaart
35 Andrew Mepham 27 Danielle Meyer 12 Araksya Mikaelyan 93 Elizabeth Miller	20 Hailey Perecki 94,96 Kirsten Peterson 78 Kelly Petrasky 38 Nick Pikaart

92,

- 28 Caitlin Ploch
- 40 Benjamin Pollock
- 49 Alex Porte
- 27 Amanda Porter
- **58** Nicholas Powers
- 74 Sarah Prill
- 27 Amber Prins
- **27** Shaylyn Pritchard
- 46 Colin Rathburn
- 36 Lydia Rau
- 21 Taylor Rebhan
- 64 Lauren Reif
- **38** Rosa Reyes
- **38** Hannah Reynolds
- 89 Ryan Richter
- **85** Zach Riepma
- 80 Dane Roach
- 14 Kara Robart
- 89,90 Kirstin Robinson
 - 91 Julia Roehling
 - 12 Stephanie Rogers
 - **95** Andrew Rose
 - 35 Andreana Rosnik
 - 99 Caitlin Roth
 - **60** Emily Rowland
 - 13 Matt Rutter
 - 21 Chikara Saito
 - 14 Sara Sanchez
 - 22 Regina Sanchez-Gonzalez
 - 23 Shubham Sapkota
 - **48** Mia Savagian

- 25,64 Aaron Sayfie
 - 92 Amanda Schab
 - **67** Lindsay Schell
 - **27** Peter Schemper
- 62,63,66 NaTasha Schiller
 - 80 Brittany Schimmel
 - 89 Christopher Schmelz
 - 95 Cory Schmidt
 - 34 K.A. Shades
 - **48** Jessica Simmons
 - 52 Daniel Simpson
 - 49 Robert Sjoholm
 - 26 Ingrid Slette
 - 87 Megan Sliva
 - **49** Thomas Smeltzer
 - **II** Brent Smith
 - **63** Daniel Smith
 - **98** Imari Smith
 - **96** Kerry Smith
 - **33** Matthew Smith
 - **33** Sherri Smith
 - **53** Cornelius Smits
 - **64** Jonathan Snavely
 - **42** Amy Speelman
 - **75** Kiley Spirito
 - 68 Allison Spyke
 - 38 Sangeetha Srinivasan
 - **72** Emily Staley
 - 22 Clara Starr
 - **42** Alyssa Stevenson
 - 89 Garrett Stier

STUDENT PRESENTERS

Heather Stiff	4 Gina Veltman
68 Catherine Stilwell	10 Stacy Victory
64 Catherine Strahle	88 Katherine Voorhorst
42 Derek Summers	85 Zak Vossen
مە Amanda Sutton	82 Jayne Vroon
65 Jenna Sutton	64 Alyssa Wagner
30 Jeffrey Sweers	ဖဖ, 93 Audrey Weil
75 Caitlin Taylor	27 Joshua Welsch
99 Rebekah Taylor	90 Lauren Welsch
22 Maxine Terry	5 Taylor Whitefield
77 Jinu Thomas	90 Sarah Wilhelm
27 Ashley Tiemeyer	10 Brent Wilkinson
22 Lindsay Timmerman	34 Marshall Willey
54 Brigid Toner	25 Angelica Willis
50 Marco Tori	20 Kevin Wonch
74 Eric Traynor	4 Natalie Woodberry
29 Jim Tufts	47 Nicholas Wozniak
92,96,98 Ryan Tussey	47 Jonathan Yarranton
9 Alexandra Tyra	37,44 Lauren Zandstra
50 Samuel Tzou	52 Russell Zinn
66 Elizabeth Unterbrink	35 John Zona
27 Andrew Valesano	0 7 Philip Zuska
22 Laura Van Oss	
29 Holly Vander Stel	
99 Jonathan Vanderbeck	
27 Amy VanderStoep	
۵۵,72,92,97 JohnVanderVeen	
33 Jacob VanderYacht	
33 Joseph Vander Yacht	
4 Kelli VanDyke	
69 Amy Veltkamp	

ARTS AND HUMANITIES DANCE

Anxiety Levels in Dancers During Performance Compared to Rehearsal, Part I: Changes in Salivary Cortisol Levels Associated with Stress

Ariana Cappuccitti, Heather Stiff, Allyson Dreger, and Rachel Cho

Mentors: Professor M. Linda Graham , Dr. Lorna Hernandez Jarvis and Dr. Gregory S. Fraley Departments of Dance, Biology, and Psychology

In dance performance, the objective is not competition or technical improvement, but to artistically engage an audience through physical expression and dynamic image. Little is known about the physiological stress response in performing dancers. The purpose of this study is to directly compare salivary cortisol changes in response to differences in perceived stresses in dancers. Seventy-three female participants from The Hope College Dance Department were asked to provide samples from 9 different states: 1 control sample of expectorant and 4 samples each per rehearsal and performance (1 hour before, 5 minutes before, 5 minutes after, and 1 hour after). Samples were prepared for analysis of salivary cortisol by enzyme-linked immunoassay (EIA). All salivary cortisol levels were normalized to the individual's control levels and presented as percent differences. Data were analyzed with an ANOVA and a Tukey HSD posthoc test using MacJMP (SAS, Inc.). A significant difference was observed in relative changes in salivary cortisol levels depending upon sample state ($F_{(8,$ $_{2021}$ = 2.48, p = 0.05). The highest levels of salivary cortisol occurred 1 hour prior to performance; interestingly, 5 minutes prior to performance, salivary cortisol levels dropped to control levels, then increased again 5 minutes after performance. We further analyzed salivary cortisol levels at each of these states taking into account the individual's experience level (expert = 12+ years of performance experience, novice = < 12 years). We found that expert dancers had significantly (p < 0.001) lower relative levels of salivary cortisol at all states except for the controls compared to novices. Our study suggests that both psychological and physiological stressors are important factors associated with dance performance, and that dance experience may play an important role in learning to ameliorate these stress factors.

Research was funded by the Howard Hughes Medical Institute (to GSF and MLG) and by a Frost Center Grant (to LHJ).

Anxiety Levels in Dancers During Performance Compared to Rehearsal, Part II: Changes in State Anxiety Levels Associated with Stress

Ariana Cappucciti, Heather Stiff, Allyson Dreger, and Rachel Cho

Mentors: Dr. Lorna Hernandez Jarvis, Dr. Gregory S. Fraley, and Professor M. Linda Graham Departments of Dance, Biology, and Psychology

In dance performance, the objective is not competition or technical improvement, but to artistically engage an audience through physical expression and dynamic image. Little, if any, is known about the psychological stress response in performing dancers. The purpose of this study is to analyze psychological anxiety associated with physiological responses. Seventy three female participants from The Hope College Dance Department were asked to complete a self-evaluation questionnaire to measure trait anxiety (STAI, Spielberger, 1983). The questionnaire served as a baseline level for each participant. We adapted the *Music Performance Anxiety Inventory for Adolescents (MPAI-A)* (Osborne & Kenny, 2004) to fit dance performance, shortening it to seven items. The inventory measured somatic, cognitive, performing contexts, and performance evaluation anxiety. State anxiety was measured 5 minutes before rehearsal and performance as well as 5 minutes after rehearsal and performance. Data analyses reveal that significant differences before rehearsal and before performance, t (70) = 6.701, p<.01, as well as after rehearsal and after performance, t (73) = 5.77, p< .01. We also found a significant difference in somatic anxiety between before and after performance, t (73) = 5.77, p< .01. These data suggest that both psychological and physiological stressors are important factors associated with dance performance.

This research was supported by the Carl Frost Research Center through a collaborative faculty-student grant.

Procyon

Helen Gay Mentor: Professor Steven Iannacone Department of Dance

Mankind has always had an intense fascination with outer space and possessed a thirst to investigate and define its mysterious depths. Through abstract movement, *Procyon* explores several concepts and theories of astronomy, including the Nebular Theory of the formation of the Solar System, gravitational and orbital forces, and the life cycle of stars. *Procyon* premiered in the Spring 2011 Student Dance Concert and was choreographed by Helen Gay in collaboration with the dancers: Kristen Beukers, Kristen Bollinger, Mikella Bryant, Elena Caruthers, Jessica Kohnen, and Michael Travis Parmelee. The music is by Deaf Center, and the lighting design and photography is by Erik Alberg. The video is courtesy of Hope College Video Services.

The Mind in Motion

Ashley Burns Mentor: Professor Maxine DeBruyn Department of Dance

In many post-performance open forums, an audience member will ask, "How did you get the idea for this piece? What did you start with?" Each choreographer has a unique approach to their choreography. In [uhn-ri-streynt], a dance performed at the Fall Student Dance Concert Knickerbocker performance in December of 2011, one dancer struggles with the various pressures and expectations placed on her. Inspiration comes from all different directions, and there are many choices to make within the choreographic process. Do you start with music, movement, or concept? First, I searched for inspiration, a purposeful message to communicate with my audience. Next, I did basic research for conceptual material in academic journals, various books, and personal conversations with the dancers. From this, I formed a more concise concept, informing improvisational sessions where material was created for the dancers. Once the piece was structured and outlined, music, costumes, and lighting were added. These elements enhanced the movement and aesthetics to create further clarity within the piece. This process resulted in five dancers embodying the demand and pressure of society and one dancer who was forced to confront these aspects of life. This demonstrates the value of dance research and performance as a way to artistically analyze various parts of the human condition.

MODERN & CLASSICAL LANGUAGES

Exploring Utopia through Graphic Novels in Les Cités Obcures by Schuiten and Peeters

Athina Alvarez

Mentor: Dr. Isabelle Chapuis-Alvarez Department of Modern and Classical Languages

The city has always been the object of fascination for graphic novel authors because it conveys both their perception of a contemporary metropolis as well as their visions for a better society. François Schuiten and Benoit Peeters are two of the most prominent 20th century key figures in this realm. In their series entitled Les Cités Obscures, they design various scénographies, decors, and architectures to create a somewhat bizarre futuristic city environment in which the destiny of its inhabitants is determined by the city itself. Schuiten and Peeters' universe appears rather ambiguous; it combines places of interest, architectural structures, and characters both real and imaginary. This presentation aims to expose the ambivalent nature of the various cities in the aforementioned albums, and to show that the graphic novel can be used as a valid medium of expression to successfully evoke worlds that are either utopian or counter-utopian.

Two Controversial Swiss Referendums and Their Consequences

Katelyn Hemmeke

Mentor: Dr. Isabelle Chapuis-Alvarez Department of Modern and Classical Languages

The Swiss Confederation recently passed two controversial referendums. The first banned the construction of minarets, which are Islamic prayer towers. After an initial controversy arose in 2005, the motion was passed in November 2009 by 57% of voters. The other referendum called for the automatic expulsion of foreigners convicted of certain crimes. This law was ratified in November 2010 by a 54% majority. Both referendums were put forth by the right-wing Swiss People's Party (SVP), also known as the Democratic Union of the Center. The results of these two referendums sparked strong reactions in the international press and drew condemnation on both national and international levels. This project examines the conditions under which these laws were able to be passed and evaluates the consequences for citizens and foreigners in Switzerland.

Versailles et Louis XIV

Katherine Kirby Mentor: Dr. Brigitte Hamon-Porter Department of Modern & Classical Languages

The chateau at Versailles during the reign of Louis XIV plays a profoundly important part in the history of France. Physical factors of the chateau itself, the governmental changes that were implemented by Louis XIV to his court at Versailles, as well as the financial consequences of the chateau's construction had many diverse effects on all areas of French life. This research focuses on the causal relationships surrounding the chateau at Versailles during the reign of Louis XIV by explaining the symbolic stylistic elements of the chateau, including the "architecture du prince". This research will also look at how the drastic governmental changes imposed by Louis XIV during his reign at Versailles created an even stronger absolute monarchy, as well as how the overabundant frivolity of Louis XIV, as seen through the chateau at Versailles, contributed greatly to France's massive debt that followed the death of Louis XIV.

The Struggle of Malian Women for the Respect of Their Physical Integrity

Lauren Miller

Mentor: Dr. Isabelle Chapuis-Alvarez Department of Modern and Classical Languages

Women's rights are inseparable from their physical integrity. Yet, women and their bodies are abused and exploited, especially in Mali. The United Nations Fund reports that 94% of the female population aged 15 to 49 years have been subjected to female genital cutting in this country. This practice finds its root in traditional, cultural, and religious practices but because of this, women suffer and see their future as mothers compromised. In addition, because of obstetrical and urological complications, death is also too often a reality. In this presentation, we will attempt to understand why in the twentieth century Malian women continue to be subjected to female circumcision while in other countries, like France, this practice is henceforth recognized as a criminal act. We will also try to evaluate the situation on the actions of education and medical care engaged in Mali by various non-governmental organizations in order that Malian women can speak out and put a stop to the practice of female genital mutilation.

The Theater of Aimé Césaire: Une Saison au Congo

Gina Veltman

Mentor: Dr. Brigitte Hamon-Porter Department of Modern and Classical Languages

Famous poet, author and Martiniquais politician, Aimé Césaire has historically influenced many people through his daringly accurate criticisms of colonialism. 1958 marks the year Césaire created his own Martiniquais political party after separating from the French Communist Party and it marks as well, the year Césaire published his first play, gradually deviating from his previous history as a poet. Over the course of his four plays, Césaire portrays the common themes of racial oppression, a hero overcoming the burden placed on his people, but ultimately failing, and the problems that arise with decolonization. Césaire's play, *Une Saison au Congo*, is based on the life of Patrice Lumumba, first Prime Minister of the Congo and considered by many to have been a heroic revolutionary and perhaps the great last hope for the country. The piece recounts the last months of Lumumba's life and his assassination, which was accomplished through the Western powers of Belgium, the Congo's former colonizer, and the United States, in its anti-Communist fervor, leaving the Congo in the hands corrupt tyrant Joseph Mobutu. These pieces are not simply stories, but carry huge implications for the politics of Césaire and other countries in their quest to clean the wounds of colonialism and rebuild. As political leader of Martinique for 56 years, Césaire's works of theatre provide insight into his political philosophies as well as being used to influence public opinion to promote understanding and healing from the past.

Improvements in the Social Conditions of Women in the Maghreb and Possible Future Developments Because of the Arab Spring

Natalie Woodberry

Mentor: Dr. Isabelle Chapuis-Alvarez Department of Modern and Classical Languages

Feminist movements in the Maghreb continue to attempt to redress the inferior social status of women, the result of multiple forms of oppression, by fighting against the social rules and customs concerning traditional gender roles in these predominantly Muslim countries. This article will explore three specific types of masculine oppression: within marriage and the family unit, of feminine sexuality, and in the workplace. The close ties between the government and Islam help to support the inferior status of women in these countries. Long-standing social traditions and widespread fear of dramatic change in the established patriarchal society also contribute to the oppression of women. Women's roles are changing rapidly in Algeria, Tunisia, and Morocco since the unrest of the Arab Spring last year. It will take time to see if, because of these recent developments, the condition of women in Maghreb has a chance of improving.

Myth, the Occult, and Experimental Writing in the Works of Mexican and European Surrealist Women Artists (1930's to 1960's)

Taylor Whitefield

Mentor: Dr María Claudia André Department of Modern and Classical Languages

Our research focuses on the lives and works of Leonora Carrington (England), Remedios Varo (Spain), Alice Rahon (France), and Nahui Olin, Frida Kahlo, (Mexico), examining their significance and impact in the feminine surrealist movement in Europe, Latin America, and the US. In addition to studying the expression of surrealism in their artistic and literary production, our study pays particular attention to the influence of esoteric traditions and myths in both European and Mexican artists. A portion will be devoted to examining the relationship between art, literature, and creative writing.

Paradoxically, all of these women artists experienced a traumatic event that triggered a narrative drive developing a strong need to exorcise fear and suffering through the artistic expression. Furthermore, all of these women wrote, often in a manner true to key surrealist themes including eroticism, madness, dreams, magic and the occult, fantastic, animal fetishism, and metamorphosis. This project presents another perspective on the works of these notable women, whom by challenging the restrictions of gender and class, gained a voice and a space of their own.

War Women: The Role of Women in Holland, Michigan during World War II

Hannah Boehme Mentor: Dr. Marc Baer Department of History

When World War II began, men were either drafted or volunteered to join the armed forces, which left a void in most communities, including the city of Holland, Michigan. The women who remained behind rose to the occasion and dedicated themselves to the war effort. This research will demonstrate the extent to which the women of Holland aided the war effort – globally, nationally, and locally. One vital way that the women helped for the duration of the war was by working in a factory located on Lake Macatawa – Fafnir Bearing. In this plant, workers produced ball bearings for a variety of military planes that flew around the world. As well, even though times were financially tight, the women of Holland saved as much as they could to invest in war bonds and, in their spare time, knitted scarves, hats, and sweaters for servicemen. Finally, it fell to the female faculty, students, and staff to see that Hope College remained a place where learning thrived. The women that remained in Holland, Michigan, though faced with adversity, met the challenges of World War II with diligence and dignity.

This research was supported by a Pagenkopf History Research Scholarship

Catholic Americanization: The Work of NCWC Community Houses (1919-1921)

Emily Fleming and Julie Oosterink Mentor: Dr. Jeanne Petit Department of History

During WWI, the National Catholic War Council (NCWC) encouraged patriotism among American Catholics to aid in the war effort and prove Catholic loyalty to America. As many immigrants at this time were Catholic, the NCWC especially promoted patriotism in Catholic immigrant communities. Toward the end of WWI, the NCWC established National Catholic Community Houses in cities across America. Catholic laywomen, called "secretaries," ran the houses by organizing classes and activities. These programs were often meant to Americanize immigrants by instructing them in such things as English, living skills, and American civics. In our research, we specifically examine the community houses in Cincinnati, Ohio and Milwaukee, Wisconsin. These houses similarly conducted Americanization work but also took on unique projects to fit the needs of the communities they served. The National Catholic Community House in Cincinnati was located in an area that was home to a large population of Hungarian immigrants. Due to the reluctance of the youth population to attend the classes offered by the Community Houses in Milwaukee, one in the Polish district and one in the Italian district. The community houses there became temporary boarding houses for many girls entering the city for work. As these girls did not always meet the moral standards of the secretaries, the secretaries learned to adapt and address the unique situations of each girl. This often meant that they had to meet girls where they were in regards to morals and lifestyles.

This research was supported by a Pagenkopf Grant and the Crossroads Project.

Theodore Roosevelt and Americanism

Jeffrey Helm

Mentor: Dr. Jeanne Petit Department of History

Theodore Roosevelt was a man who defined an era of United States history. From 1881, when he was first elected into political office, until his death in 1919, Roosevelt expressed his views on national identity, Americanism, civic duty, and "the strenuous life" in personal letters and public speeches. The themes that Roosevelt expressed were consistent: be American and not anything else, find meaningful work and do it, be strong and bold, and above all strive to live a strenuous life fighting against a sedentary life. By examining his personal letters and public speeches, I show how Roosevelt's ideas of hard work and national identity went hand in hand, and he believed that any man of European descent was capable of becoming a great American citizen no matter what his background. While he did support some racial limits to citizenship, his views on race and class challenged the Anglo-Saxon power structure of the time. Also, his sense of civic duty and nationalism never wavered. Theodore Roosevelt changed how Americans during the Progressive Era and World War I viewed themselves as Americans. By following Roosevelt's example, America became the America it is today.

The Christian and Missionary Alliance and the Question of a Native Church in the 1920's

Matthew Keller Mentor: Dr. Gloria Tseng Department of History

Since the beginning of Christianity, the Church has been involved in spreading the Gospel's message of universal salvation. Yet, wherever Christianity has gone, it has almost always conflicted with the societies it has encountered. In the early twentieth century as China was undergoing sweeping political changes and becoming a more modern nation, Chinese Christianity was developing an identity of its own. Some missionaries and Chinese Christians were working to direct the growth of a Chinese Christian identity, while also maintaining the connections of the mission churches with the home churches. However, others looked for a complete break between the Western churches and the Chinese Christians, seeking devolution of control to the Chinese and the formation of a united and national Chinese Church throughout the country. At the heart of this competition was the struggle between Liberal and Fundamentalist Christianity, in which one side emphasized the spirit of Christianity and the other emphasized the institutions of Christianity.

Among the many missionary societies active in China at this time was the Christian and Missionary Alliance (C&MA), an interdenominational missionary society founded in 1897 with a focus on foreign missions. The C&MA's Alliance Weekly magazine included stories from its missionaries in the field, which told of their work involving natives and provided evidence of the Alliance's efforts to bring about a national church headed by the Chinese. Yet, in 1926, less than a year before this goal was to be accomplished by the National Christian Council (NCC) with the establishment of the Church of Christ in China (CCC), the C&MA withdrew its support of the NCC based on fears that the native church would be a faulty manifestation of Christianity and thereby abandoned the event which would have fulfilled their mission's dream of a church led by the Chinese.

This material is based upon work supported by the 2011 Jacob E. Nyenhuis Faculty Development Research Grant.

Dorothy Day: A Countercultural Divine Activist

Anne Baenziger Mentor: Dr. Jeanne Petit Department of History

Oxford dictionary defines the term "counterculture" as "a way of life and set of attitudes opposed to or at variance with the prevailing social norm." Throughout the twentieth century there were many countercultural movements led by religious believers who sought to take action on public concerns and even political policy. This poster will examine Dorothy Day's Catholic Worker Movement is an example of one such movement. Inspired by her Catholic religious beliefs, Day started the Catholic Worker Movement which served as a vehicle for her to profess and practice ideas that were drastically against the social norms. She challenged the culture around her by stretching gender roles, standing against a popular war, and embracing poverty when other Americans aspired for greater material gain. Dorothy Day was a writer, activist, socialist, mother and devote Catholic through all of these roles she had a great impact on the twentieth century American culture.

The Coexistence of Contradictory Ideological Tendencies in the British Boy Scout Movement before World War I

Cory Lakatos Mentor: Dr. Marc Baer Department of History

The Boy Scout movement, founded in the United Kingdom by the Boer War hero Robert Baden-Powell in 1908, was arguably the most successful youth organization of the twentieth century. Within two years it was the largest organization of its kind in Britain; by 1914, it was the largest in the world. The extraordinary way in which Scouting spread outward from Britain to become an immense international body with millions of Scouts and adult leaders, as well as the near-legendary status that Baden-Powell himself attained, has led historians of Edwardian Britain to scrutinize the origins and significance of the movement as well as the means by which it became so popular. Scouting's original stated goal was to train boys to be good and useful citizens of the British Empire by means of physically strenuous outdoor activities and a strict code of ethics and discipline. However, many scholars have questioned the motives of the organization's leaders, pointing out their conservative, imperialistic, and even militaristic views.

This research examines the Boy Scout movement in Britain from its inception to the eve of World War I. It reveals that the organization incorporated seemingly contradictory ideological views into its central message and suggests that this allowed it to establish itself in the middle of the political spectrum, where it could appeal to British youths and adults from a wide range of class and ideological backgrounds. Special attention is paid to the writings of Baden-Powell and to the issues of degeneracy, class conflicts, race, militarism, and the challenges facing the British Empire.

Let Us Live Again in the Past: The Origins of the British National Trust

Alison Lechner Mentor: Dr. Marc Baer Department of History

Following upon a century into British industrialization, there developed a growing public concern regarding the massive economic, physical and social changes that flowed from industrialization, a concern ultimately about the future of the world's first modern society. The founding in 1896 of the National Trust was one outcome of growing unease about unchecked industrial transformation. This research will demonstrate how the formation of the National Trust resulted from a combination of three concepts of preservation: the Open Space Movement, the Southern Metaphor and Provincialism. Efforts at preservation ranged from societal to political to environmental, and represented a wide array of means to a similar end – preserving the past to shape the future. They represented various reactions to modern industry in Britain at the end of the nineteenth and beginning of the twentieth centuries, and collectively made a positive statement about public opinion on preservation at that time.

Race: Is It All In The Head? The Perspectives of Samuel George Morton

Felicia Mata Mentor: Dr. Jeanne Petit Department of History

A craniologist from Pennsylvania, Samuel George Morton measured various aspects of skulls from ethnicities across the globe. This study focuses on two of his books: Crania Americana, published in 1839, and Crania Aegyptiaca, published in 1844. In them, he argued that from the start of time each race came from a separate origin (polygenism). This argument was in opposition to Christian defenders of slavery who believed all people originated from Adam and Eve (monogenism). His first book divides humans into five races and gave what he saw as empirical data that Caucasians were superior to all other races due to their greater skull volume. Morton placed Blacks on the same level as animals, and believed that the institution of slavery kept them in their place. In his second book, he examined ancient Egypt to prove that these hierarchies have been in place since the beginning of time and that even in ancient civilizations blacks worked as slaves. His studies created a racial caste system that made races separate and not equal, and any race that was not Caucasian had no hope of ever reaching the most superior standard. His experiments quieted the debate between monogenists and polygenists, and people went as far as reinterpreting the Bible to give a rationale for origin of separate races. He helped introduce scientific racism to America which contributed in the unequal treatment and racial harassment of African Americans throughout history.

The Appeal of Womanhood: British Women Against the Vote, 1880-1918

Alexandra Tyra Mentor: Dr. Marc Baer Department of History

The 1880s saw a movement in Britain that focused on the "New Woman." In turn this engendered fear that as women became more prominent in society, seeking not only political equality but increased leisure and luxury they would move away from their traditional motherly duties. As pro-suffrage groups began to form in the late 19th century, they were countered by anti-suffrage groups such as the Women's National Anti-Suffrage League. Female anti-suffragists held strongly to their belief that women were in charge of the home sphere, which included familial duties as well as local philanthropy. It is for this reason that the anti-suffragists have been thought to be anti-feminist. However, the calling to be good mothers and wives was perceived as invaluable to the home front as well as the empire. The feminist ideal which female anti-suffragists embraced was not the more socially-liberating version in which women abandoned their motherly duties in pursuit of other interests. Rather, it was the feminism that upheld the essence of femininity—to fulfill God's plan to be nurturers and supporters of the family who would carry on the idea of British exceptionalism in all aspects of public life. This research explains the development of suffrage opposition groups, their arguments against women's enfranchisement, and the actions they took in order to gain support for their cause.

Franklin D. Roosevelt's Appeal to Working Class Americans through the Domestic Fireside Chats

Stacy Victory Mentor: Dr. Jeanne Petit Department of History

Between 1933 and 1944, President Franklin D. Roosevelt gave a series of thirty radio addresses that have come to be known as "The Fireside Chats." This study examines how Roosevelt used the domestic fireside chats given between March 12, 1933 and June 24, 1938 to appeal directly to working class Americans who were struggling to get by during the greatest domestic crisis in American history, the Great Depression. The research shows how the working class had become an ostracized segment of the American population both economically and politically in the years prior to the onset of the Depression. Roosevelt recognized that the working class represented a valuable portion of his constituency and employed a number of strategies to reconnect with workers. A careful analysis of the domestic fireside chats shows how Roosevelt tailored them to meet the needs and interests of a working class audience. Roosevelt worked to reconnect this ostracized social class and create a more unified American people in order to combat the hardships of the Depression.

Prayer and Politics: Two Roads to Philanthropy in Victorian Britain

Brent Wilkinson Mentor: Marc Baer, PhD. Department of History

George Müller and the Seventh Earl of Shaftesbury, Anthony Ashley Cooper, were men of different nationalities, class, and profession, but they were united in their Christian faith and in their efforts to change the lives of the poor in Victorian Britain. The Earl used his political influence to pass laws for the protection and just treatment of factory and mine workers, chimneysweeps, the insane, and countless other disadvantaged groups. George Müller ran an orphanage that at its height hosted 2,000 children. He never solicited donations or announced the needs of the orphanage, relying entirely on prayer to raise funds. Though originally from the poorest of the poor, Müller's orphans were well-fed and well-educated, and many received professional training or apprenticeships upon leaving the orphanage.

In addition to helping thousands of people directly, Müller and Shaftesbury were also essential to changing notions of "deserving" and "undeserving" poor, notions that are still affecting government and private charity today. The research focused on how these men led their age into a broader understanding of philanthropy and charity.

This research was supported by a Crossroads Project grant.

Persistence: A Composition Project

Caitlin McDougall Mentor: Dr. Christina Hornbach Department of Music

Through the Jacob E. Nyenhuis Faculty Development Fund at Hope College, I was privileged enough to work on a songwriting and composition project with Dr. Christina Hornbach. The goals of this summer project were to continue to work on an original musical that I have composed, and to go further in depth with this project though music notation, audio recording, legal research and performance opportunities. The intended goal for this summer was designed to help further the legitimacy of the musical and to turn a creative idea into a production that can be performed. A musical is a large work, and part of my time this summer made me realize that in order to make my creative thought a reality, I must invest much of my energy into the music and the script. Much of the time spent on this project was devoted to recording, writing, notating, and revising, I was able to produce a full piano vocal score of over 150 pages, a fully orchestrated demo recording of the entire musical, contact legal personnel, revise the script and hold a script reading with HSRT cast members, notate a fully orchestrated overture score as well as write a choral arrangement for the Holland Area Arts Council's Debut spring youth arts showcase, over the course of 8 weeks.

Singing Through the Trumpet: Arnold Jacobs' 'Song and Wind' and the Trumpet

Erin Johnson

Mentor: Dr. Julia Randel Department of Music

As with any instrument, performing successfully on a brass instrument is a challenging task that many musicians, including professionals, have encountered for decades. In an attempt to find a solution to these challenges, Arnold Jacobs, principal tubist for the Chicago Symphony Orchestra from 1944-1988, spent many years poring over neurology and physiology books, analyzing the playing of fellow members of the Chicago Symphony brass section such as Adolph "Bud" Herseth, and testing his ideas on both himself and his students. The result of all his work was the creation of 'song and wind,' an approach that combines the creativity of the mind and the technical skills of the body while preventing the paralyzing mental analysis that many musicians encounter. This paper looks to answer why 'song and wind' is so useful for brass players as well as how this idea is effective in trumpet pedagogy. Several books written by former students of Jacobs, multiple personal accounts of professional brass players using 'song and wind,' and interviews and journal articles from the *International Trumpet Guild Journal* relay Arnold Jacobs', Bud Herseth's, and Vincent Cichowicz's own thoughts on 'song and wind.' From these investigations, one can conclude that 'song and wind' is a very practical approach to easing the challenges of playing a brass instrument by mentally singing and playing an instrument simultaneously. In addition, through looking at the relationships in the ideas of colleagues Jacobs, Herseth, and Cichowicz, one sees that 'song and wind,' although created by a tuba player, can easily be applied to trumpet pedagogy and continues to be passed on to future generations of brass students today.

Dialogue and Collaboration in Manuel de Falla's Ballet, Le Tricorne

Brent Michael Smith Mentor: Dr. Julia Randel Department of Music

This project examines the interactions of music, choreography, visual designs, and text in the ballet, The Three-Cornered Hat (1919), in an attempt to recapture some of the conversations about Spanish music, dance, art, and literature, which we know to have taken place, but which survive only in some agonizingly non-specific accounts in the players' memoirs. Each artist had his own investment in the subject: for Massine, Spanish dance as well as Spanish art and literature were new enthusiasms that would become lifelong passions. For Picasso and Falla, this piece represented a return to a homeland that had received their previous work with ambivalence. During their collaboration, each undertook serious study in order to determine how best to represent Spanish culture on stage. It was Picasso who suggested that Falla add voices to the score because "it would be very Spanish." Throughout the score we can see a rich cross-fertilization of influences: of painting on choreography, of dance on music, and of literature on scenic design, all drawing on high art as well as folk culture.

INTERDISCIPLINARY

Bridging the Gap: Designing and Implementing a Model Solution for the Holland Community's 'Gap' Homeless Population

Alexandra Day, Katelyn Barry, Araksya Mikaelyan, and Stephanie Rogers

Mentors: Dr. James Boelkins and Dr. Virgil Gulker Center for Faithful Leadership, ASI Consulting

In the fall of 2010, the Holland Rescue Mission (HRM) approached the ASI Student Consulting Program at the CFL for assistance in addressing the long-term housing needs and support for members of the "gap" homeless population in the Holland community. This is a segment of the homeless population that is too high functioning to be considered legally disabled, but too low functioning to live independently. Members of the "gap" population are chronically homeless and require significant financial resources and services; consequently, there are no existing programs which directly address their unique needs for housing and support. The purpose of this research was to design a model solution for the Holland Rescue Mission to provide permanent housing social services, and then further assist with the implementation of the solution. So far, ASI designed the model, helped secure a home (Shepherd House), designed a client housing agreement and application, interviewed "gap" clients, and developed educational materials for sharing with local churches about this problem. Future work will focus on assessment of the model and replication of it with additional homes supported by local churches and social service agencies. Additionally, ASI will begin to present their work to the community to build a large network support system within a Christian community.

The Twist is Here to Stay

Jillian Conner

Mentors: Dr. Jeanne Petit and Professor Matthew Farmer Departments of History and Dance

Nowadays, the Twist, both the song and the dance, is a common sight at weddings. It's a relatively simple move that both young and old know, typically classified in the same repertoire as the Bunny Hop and the Electric Slide--cheesy and slightly ridiculous, but a fun classic. This research reveals that when the Twist was first introduced on *American Bandstand* in the 1960's, adults, particularly the parents of teenagers, viewed it as anything but harmless or cute. The Twist shocked adult culture and seemed to cue the impending downfall not only of social dance, but of American morality. As the baby boomer generation came of age, the Twist became a cultural icon of the new youth in revolt in the youth-obsessed culture of the time. It began a national dance craze, breaking all previous social dance rules and radically altering dance styles on a widespread basis, from very structured partnering to individual expressions of sheer enjoyment. Today's solo freestyle dancing was set in motion by the Twist.

Payday Practice – Financial Literacy Initiative

Matt Rutter Mentor: Dr. Virgil Gulker Center for Faithful Leadership, ASI Consulting

In the fall of 2010, Community Action House (CAH), a non-profit organization in Holland, MI, approached ASI Consulting with a radical vision to put itself out of business by equipping children and families with the tools for financial freedom. This sentiment is reflected in their mission statement, "to break the cycle of poverty by empowering families and individuals to achieve self-sufficiency." ASI accepted this challenge and partnered with CAH on this project.

After extensive research of existing national standards for financial literacy, ASI set forth to create a survey to assess the personal finance education currently offered in Holland Public Schools. ASI then compared the results to existing financial literacy programs and the best practice standards for personal education materials distributed by state and national educational institutions.

The third through fifth grade students of Holland Jefferson Elementary were administered a fifty-four question survey in May of 2011. The survey data revealed two main conclusions: (1) Students have a strong ability to recall and communicate financial information and concepts, and (2) There is no statistically significant difference between the responses given by students of differing socio-economic backgrounds.

Though most students and adults of all income levels have a basic understanding of financial concepts, these teachings too rarely influence one's spending and saving behavior outside the classroom. Working with a team of mentors and advisers, ASI chose to focus on teaching the "Concept, Integration, and Application" of all financial matters.

Currently, ASI is working with Holland Jefferson's fourth grade to integrate personal finance teachings into the state curriculum standards and Market Day program. ASI's newly developed activity, named "Payday Practice," allows students to intentionally prepare for their first paycheck – what they will save, what their expenses may be, how to develop a budget given income scarcity, and more.

The Yorkshire Moors in the Romantic Tradition: Emily Brontë's Wuthering Heights and J. M. W. Turner's Frosty Morning

Kara Robart

Mentor: Dr. Kathleen Verduin Andrew W. Mellon Scholars Program and Department of English

Barren, mysterious, destructive, powerful and threatening. Those are some of the ways in which the natural world was viewed during the Romantic period, an artistic, literary, musical and intellectual movement of the late-18th and early 19th centuries. But what does it mean for something to be "Romantic," and how did the various artistic mediums of the period – such as art and literature – interact with one another? In what ways were those depictions similar, and how were they different? Most interdisciplinary examinations of romantic painting and literature focus on poetry rather than novels. This study, however, compares the ways in which "nature" was portrayed according to the Romantic traditions of art and prose, focusing particularly on Wuthering Heights (1847), a novel by Emily Brontë, and Frosty Morning (1813), an oil painting by J. M. W. Turner. Both artists set their works in the lonely Yorkshire moors, choices that impacted the way their subject matter is perceived. This study delves into these settings, providing a model for the ways in which similar traditions can be examined across entirely separate cultural forms.

"Teasing with the Fumes": Succèss de Scandale and the Reception of Sylvia Plath and Anne Sexton

Sara Sanchez

Mentor: Dr. William Pannapacker Andrew W. Mellon Scholars Program and Department of English

In 1963 and 1974, Sylvia Plath and Anne Sexton, respectively, shocked readers with their suicides. Since then the two poets have received an increasing amount of attention in U.S. culture and literary criticism. The circumstances of their deaths and unstable lives created a prurient curiosity, a succès de scandale, which has simultaneously overshadowed their works and given them an iconic status as authors. This project explores the parallel cultural and critical reception of Plath and Sexton through publications about them in the decades since their deaths. In particular, the project examines how the authors' portrayals have complicated their reception in educational contexts by both undermining the literary standing of their work while attracting an adolescent audience based on the circumstances of their biographies.

"Songs from the Dark": The Origins of German Romantic Opera and Its Ties to English Gothicism

Kelli VanDyke

Mentor: Dr. William Pannapacker Andrew W. Mellon Scholars Program and Department of English

The development of German romantic opera is often credited to Carl Maria von Weber (1786-1826) with his opera *Die Freischütz* (1821). This opera features elements of the German artistic movement *Sturm und Drang*, which focused on expression and mysticism. The primary literary leaders of *Sturm und Drang* were Johann Wolfgang von Goethe (1749-1832) and Friedrich Schiller (1759-1805). When English Gothicism spread to continental Europe, more writers began to try their hand at their own terror stories, such as Schiller himself with his novel *Der Geisterseher* (1787-1789). With the increasing level of Gothicism appearing in Austria and Germany towards the end of the 18th century, how did it influence the development of the German Romantic Opera? How did Mozart's Vienna react to a darker style of opera after a long period of the comical *Singspiel*? How did *Sturm und Drang* continue to influence opera in the 19th century? My project shows how, by the end of this process, the name most associated with the movement of German Romantic Opera would be German composer Richard Wagner (1813-1883).

The Hybridization of Peacekeeping: The United Nations Mission to Liberia Revisited

Daniel Owens

Mentor: Dr. Tamba M'bayo Andrew W. Mellon Scholars Program and Department of History

During the Liberian civil war (1989-2003), the Economic Community of West African States (ECOWAS) deployed the ECOWAS Monitoring Observer Group (ECOMOG) to Liberia. This attempt at regional peacekeeping marked the first incidence when the United Nations (UN) entered into a peacekeeping partnership with a regional organization — in this case ECOWAS. Despite the limited success of the combined ECOMOG/UN mission, the "hybrid" model of peacekeeping has since become the norm around the world, in Africa in particular. Profuse scholarship is available on this approach, but further study is required due to the continual evolution of peacekeeping. With this in mind, it is necessary to re-visit previous hybrid efforts in light of more recent examples such as the recent UN interventions in Côte d'Ivoire and Sudan that pose new challenges worthy of serious attention. The UN/ECOMOG partnership in Liberia provides an excellent reference point for such an investigation. This paper re-visits the actions of ECOMOG and the UN in Liberia. It draws on an extensive collection of Liberian newspapers and memoirs to examine the achievements and failures of the intervention. It uses primary source material from UN archives as well as secondary sources to explore the fragile relationship between ECOMOG and the UN mission to Liberia. Many of the challenges associated with the hybrid model are addressed. This sets the stage to place the case of Liberia in the broader context of recent peacekeeping missions. Stressing the necessity of adopting a case-by-case approach, the paper suggests a hybrid model for peacekeeping missions in Africa — one that empowers regional and sub-regional organizations to take the lead in peacekeeping on the continent.

This research was supported by a Jacob E. Nyenhuis grant.

European Women in the Mexican Surrealist Movement: Remedios Varo and Leonora Carrington

Tessa Angell

Mentor: Dr. Maria Claudia André

Andrew W. Mellon Scholars Program and Department of Modern and Classical Languages

Scholars largely overlooked the contributions of women to the surrealist movement of the twentieth century until the women's movement of the 1960s and 1970s, when scholarship in this field began to increase. Heightened interest in the women of Surrealism has helped discover and establish the importance of their presence in the surrealist conversation. Their artistic expressions were not limited to painting and photography, but also included poetry, film and dance. Their contemporaries, both male and female, had great influence on the artistic process and production; additionally, travels between Europe and the Americas greatly influenced their work. My research focuses on two European-born surrealist artists who lived and worked in Mexico for the majority of their lives: Remedios Varo and Leonora Carrington. Varo was born in Spain in 1908, but fled to Paris during the Spanish Civil War, where she encountered Surrealism. After she moved to Mexico in 1941, Varo was employed by the medical company Bayer to illustrate advertisements; it is in these thirty known pieces that she defines her unique style and distinctive subject matter. Her greatest inspirations were science, Gothic architecture and esoteric doctrines, like the Tarot, alchemy and Kabbalah. Carrington was born in England in 1917, and like Varo, discovered Surrealism in Paris. She then moved to Mexico, where she produced the majority of her work. Carrington's style is marked by her "black humor," that explored death in terms of the Mexican culture. She also explored the Western "consumption" of other cultures through symbolism of cooking and eating. This research is part of a greater project, headed by Dr. Maria André, to make further discoveries and connections in the field of women and surrealism, and to make this information more accessible to scholars and the public through dissemination on the web.

Tulips as Cultural Emblems in 17th-Century Netherlands

Athina Alvarez

Mentor: Dr. Anne Heath

Andrew W. Mellon Scholars Program and Department of Art and Art History

Living in Holland, Michigan, we are often exposed to the ubiquitous tulip and the word "tulipmania." This project, however, will explore the complex history of what the tulip symbolized in 17th-century Netherlands, and will aim to explain the historical development of tulipmania and its social and cultural significance. Using a variety of contemporaneous artistic media including oil paintings, woodcuts, and rare books, my research will focus on the various ways in which the tulip represents cultural identity, spirituality, and economic power during the Dutch Golden Age.

Virginia Woolf's Exploration of Bipolar Disorder in To the Lighthouse

Elizabeth Badovinac

Mentor: Dr. Amy Bade Andrew W. Mellon Scholars Program and Department of Psychology

Many scholars – from 1972 Freudian analyst Nancy Topping Bazin to 2007 social scientists Katherine Thomas and Marshall Duke – have speculated on the inherent motivations for Virginia Woolf's many novels. Perhaps most especially in her 1927 novel, *To the Lighthouse*, Woolf's unique writing style is often considered to have been a mere product of a female author confined by societal limitations and mental instability. Arguably a most important element in all of her writing, the *intentional* examination of Woolf's mental disorder in her character development is often problematically overlooked. Even the respected theories of Gilbert and Gubar, which suggest that early women authors wrote to curb anxiety about societal limitations, neglect to remark on less gender-oriented, more objective endeavors to explore the underdeveloped models of psychological mental disorders, like Woolf's alleged bipolar disorder. *To the Lighthouse* – particularly through the thoughts of its three main characters – shows an emergence of Woolf's objective, scientific endeavor to understand that specific malady. By bridging the gap between what we now know as psychology and abstract literature when studying the novel's characters, I submit that Woolf's motivations in *To the Lighthouse* were more than just a product of her societal anxiety; the novel's characters, in fact, became her attempt to make her contribution to underdeveloped 20th-century psychology and to explore the complexities of her own mind.

To Cure the Criminal: The Practice of Institutionalization in Asylum and Penitentiary History

Anthony Bednarz

Mentor: Dr. Natalie Dykstra Andrew W. Mellon Scholars Program and Department of English

The practice of separating the poor, the insane, and the criminal from society has existed for centuries. In the United States in the nineteenth century, the practice of institutionalization to cure mental illness produced inhumane conditions in insane asylums. Thanks in part to the efforts of social reformers, the asylum system has become obsolete. However, the practice of institutionalization is still practiced in the American penitentiary system. Using the autobiography of Clifford Beers, an asylum inpatient from 1900 until 1903, and a history of the Eastern State Penitentiary in Pennsylvania, I will draw comparisons between the asylum system and the penitentiary system in both ideology and practice. Just as separating the individual from society failed to cure the insane, institutionalization in the penitentiary system has failed to "cure" criminality. Using Tocqueville and Foucault as resources, I will show that while separation functions as a punishment, it creates a moral environment that makes rehabilitation impossible.

The Creative Process of Composer Clara Schumann

Katherine Callam

Mentor: Dr. Julia Randel Andrew W. Mellon Scholars Program and Department of Music

Clara Schumann (1819-1896) presented her first solo piano concert at age eleven and was soon considered equal to the virtuoso Franz Liszt. She married the composer Robert Schumann, corresponded with the composer Johannes Brahms, raised seven children, and composed over forty works in several genres. Despite these accomplishments, she struggled with self-doubt regarding her compositions and creative abilities. She lost confidence in her Piano Trio in G minor, op. 17, after her husband composed his own trio. Although Schumann's trio is her longest and most complex work, it has never before been subject to an in-depth source study. The autograph manuscript, preserved at the Robert Schumann-Haus in Zwickau, Germany, contains substantial revisions that offer a window into Schumann's creative process. The researcher compared over nine hundred measures of the manuscript (in a digital copy) to the first edition of 1847, noting discrepancies in pitch, note value, articulation, and dynamics; she also transcribed almost two hundred measures crossed out by Schumann. That analysis revealed that Schumann revised melodies and transition sections almost exclusively, which greatly improved continuity between musical ideas in the trio. The manuscript's revisions point to a thorough and well-organized compositional craft, despite Schumann's fears of inadequacy. An understanding of Schumann's revisions allows performers to interpret the trio in a more meaningful way. Decisions regarding the phrasing of melodies, for example, can be guided by their development throughout the compositional process. This informed approach to interpretation will draw performers and listeners closer to Schumann's personal vision of the trio.

Reading, Writing, and Living the Revolution: Intertextual Conversation in Ginsberg's "A Supermarket in California"

Kayleigh Forlow

Mentor: Dr. Jesus Montaño Andrew W. Mellon Scholars Program and Department of English

Allen Ginsberg was one of the most influential poets of the Beat Generation, a group of writers whose work provoked social revolution beginning in the late 1940s. Though Ginsberg is often remembered for Howl: and Other Poems (1959), as well as the trial of this work's content for "indecency," my project focuses on a less frequently discussed poem from Howl: "A Supermarket in California." In "A Supermarket in California," Ginsberg transforms his stroll through a conventional supermarket into a forum for discussing his revolutionary stance within United States culture with imagined companions, poets Walt Whitman and Federico García Lorca. Much of the critical response to this poem characterizes it as a critique of middle-class materialism in the 1950s and neglects Ginsberg's choice of companions. My research expands upon George Monteiro's claim in his recent article "Peaches and Penumbras: Ginsberg's 'Supermarket in California'" that Ginsberg invokes Whitman and Lorca, because poets summon "poets of the past for comfort and reassurance." I propose Ginsberg means to do more than just seek "comfort and reassurance" from Whitman and Lorca, suggesting Ginsberg is pursuing their guidance in reshaping the mainstream culture of his America to be more socially accepting. Whitman in the 19th century and Lorca in the 20th were both supporters of marginalized social groups, as well as inhabitants of socially and politically polarized nations. Consequently, Ginsberg saw these men who used their poetry to endorse creation of more accepting social communities as role models for his revolutionary poetic aspirations. My project is an introduction to addressing how the ongoing dialogue between revolutionary poets has produced a shared vision of a more congruous political and social order that has been passed down over time, exemplified in the discourse between Cuban intellectuals of the 1960s living under Castro and the Beats in the Cubalogues.

Twins and Eugenics in the Holocaust

Lauren Ezzo

Mentor: Dr. Jonathan Hagood Andrew W. Mellon Scholars Program and Department of History

My project examines the use of twins as subjects for experimentation in the Holocaust and the history of gemology--the scientific study of twins--as an experimental field. Since the early 1800's with Francis Galton's first inquiries into the causes of twinning, the field has been closely linked with eugenics, the study of selective breeding. I argue that there is a direct connection between these experiments and Joseph Mengele's infamous Auschwitz twin studies. The studies involved sets of twins taken off the arrival ramps at Auschwitz in order to live in a block segregated from the rest of the camp specifically to be used as control and experimental subjects. While there are relevant studies on the experiments performed in the camps, a study has never been undertaken on the reasons for Mengele's special interest in experimenting upon twins. Using records from Mengele's studies, as well as photographic evidence, I will argue that Mengele was influenced in his early days of medical school by the research environment of Europe in the first half of the twentieth century.

Still America's Pastime: The Longevity of Baseball in U.S. Culture

Bill Getschman

Mentor: Dr. Jeanne Petit Andrew W. Mellon Scholars Program and Department of History

Robert Frost once wrote "I am never more at home in America than at a baseball game." To some Americans, a baseball field is hallowed ground; it is a sacred space. Fans devote their time, money and emotions to a group of men who, in reality, play a game for a living. The Chicago Cubs have been heartbroken year after year and have not won a World Series since 1908, but why is their fan base one of the strongest in the country? Why do fans in general devote so much time to their hometown baseball club? In the twentieth century, baseball was the king of the entertainment industry. In 1930, Babe Ruth was the first player to have a higher salary than the President. He changed the way baseball was played by hitting towering home runs, years before the home run became an art of the game. The twenty-first century is showing that more Americans enjoy football and basketball over baseball. In the summer of 2010, an NFL preseason game got a higher overnight rating (television) than a Yankees vs. Red Sox game, the fiercest rivalry in baseball. Despite escalating popularity of football and basketball, I will argue that there are ongoing historical and cultural reasons that account for the longevity of baseball as "America's pastime."

Dancing for Democracy: How Dance Influenced the Cultural Conversation of the Cold War

Kaitlyn Holmwood

Mentor: Professor Matthew Farmer Andrew W. Mellon Scholars Program and Department of Dance

During the international cultural exchange that occurred during the mid-20th century—the period of after World War II ended in 1945 and before the height of the Cold War in 1957—dance and other performance arts were used as a means of political propaganda. Though many arguments tensions existed between the Soviet Union and the United States, perhaps one of the more understated forms of struggle was each power's use of dance to reveal the benefits of either capitalism or communism. To demonstrate how dance could play a significant role a political conflict, I will show how the "Western" and often overly democratic content of Agnes de Mille's ballet *Rodeo* was utilized to highlight the differences between Russian ballet and American dance and to promote the values of Western capitalist nations at the time.

MELLON SCHOLARS

A Revolution in American English: The Transformation of American Spoken Language from the 1940s to the 1970s

Tessa Judge

Mentor: Dr. William Pannapacker Andrew W. Mellon Scholars Program and Department of English

American English is a language comprised of dialects that identify the origins of the speaker, such as the South, New York, Boston, and the Midwest. There are also numerous variations within in each of those dialects. Nevertheless, American English as a whole has a distinct sound that is different than, say, British English. A Southern dialect is still American English. The expression of those dialects has changed over time as well. American English today has a different sound than it did as recently as the 1950's. Films have made this change in language most obvious. In my project I examine how the standard American English in films made before the 1960s had all but vanished by the 1970's, when representations of American English became more naturalistic, reflecting the political and cultural changes of that time while also cultivating qualities that reinforced the ongoing construction of a common national language.

History and Environmental Issues in the Lake Macatawa Watershed

Lauren Madison

Mentor: Dr. Steven Bouma-Prediger Andrew W. Mellon Scholars Program and Environmental Studies

In researching the natural history of Holland, Michigan, an issue of great environmental significance that quickly emerges is the health of Lake Macatawa, which lies just blocks away from Hope College's campus, and its encompassing watershed. A watershed is an area drained by a body of water; in the context of Holland, water is drained from surrounding rivers and wetlands through Lake Macatawa, and eventually into Lake Michigan. I approach this topic from a historical standpoint, examining from the distance of over a century and a half the effects of human impact, specifically in terms of land usage, on the health of the watershed. I will show that since its settlement by the Dutch, the environment of Holland has been significantly altered and neglected, and the Lake Macatawa Watershed has been damaged as a result. The watershed is in a

state of hypereutrophia, brought about by excessive phosphorous levels due to pollution. This condition makes it difficult for life to flourish in the watershed, and it is the main concern of those who care about protecting and preserving Holland's beautiful natural environment.

From 'Savage' to 'Civilized' and Back Again: White-Cherokee-African Relations from 1790 until 1861

Madalyn Northuis

Mentor: Dr. Fred Johnson Andrew W. Mellon Scholars Program and Department of History

In August 2011 the Cherokee Nation Supreme Court retracted Cherokee citizenship from approximately 2,800 freedmen, the descendants of African slaves formerly owned by Cherokees, because they could not legally prove their Cherokee lineage. Although 1,200 freedmen were reinstated as citizens in September, 2011, the freedmen's opponents within the Cherokee Nation continue to dispute the issue. In contrast to the majority of recent media publications, which tend to view this issue through a historical lens spanning from 1865 until the present, my project examines the origins of the Cherokee Nation's enslavement of Africans from 1790 until 1861. I posit that members of the Cherokee tribe began to own African slaves in the late eighteenth century as a desperate attempt to be judged equal by white society. Even though their efforts to gain access to the exclusive rights of U.S. citizens were repeatedly thwarted by political policies, such as the Indian Removal Act of 1830, slavery became an integral part of Cherokee tribal life. Additionally, just as the Cherokees became acculturated to the ways of white society, the African slaves living within the Cherokee Nation became assimilated to the Cherokee's culture. Upon becoming Cherokee citizens in 1866, the African freedmen consistently identified themselves as Cherokees and actively participated in the political and social events of the Cherokee Nation. I argue that the freedmen have proven to be loyal members of the Cherokee Nation and have earned the right to be legally recognized as Cherokee citizens.

MELLON SCHOLARS

Creativity in Community: Using the Inklings as a Model for Collaborative Groups Today

Amanda Palomino

Mentor: Dr. Peter Schakel Andrew W. Mellon Scholars Program and Department of English

Poet John Donne wrote, "No man is an island." A person does not exist in a vacuum; for that matter, neither does an idea. In most historical studies of creativity, research has centered on individual artists, musicians, and writers. However, the preoccupation with the individual has constructed a myth of the solitary genius, which suggests that a creative person must work alone and that a truly creative idea must come from within. Although it is true that the invention of an idea must occur within one brain, one should not make the mistake of overlooking or underappreciating the effect of the outside world. Realizing that the creative process is just as much socially influenced as it is psychologically based, we can gain new insight into the significance of collaborative communities. This case study in particular focuses on the Inklings, an informal circle of British writers that included C.S. Lewis and J.R.R. Tolkien. By delving into the social dynamics of that group, this study examines how that collaborative environment influenced the individual members in their writing careers. The purpose of this study – based on the observed techniques of successful group functioning and synergy that inspired the Inklings' creative work – is to build a model for creative collaboration that can be used by similar groups today. Integrating the traditional methods of the Inklings with the modern tools available for increasing communications now, this study aims to provide creative professionals and amateurs alike with a framework for "creating together" in the twenty-first century.

When Images and Words Collide: The Artist Book and Where the Wild Things Are

Hailey Perecki

Mentor: Professor Katherine Sullivan

Andrew W. Mellon Scholars Program and Department of Art and Art History

Many adults and children may recognize Maurice Sendak's children's book *Where the Wild Things Are*, but what they probably do not think about is that the original text and images were not a scattering of pages or a clean cut proof, but a bound hand-drawn "prototype" book, or what is referred to as an "artist book." The original artist book for *Wild Things* is the predecessor of the manufactured and marketed book that people see on store shelves. The artist book. Maurice Sendak's book *Wild Things* is a prime of example. Unlike previous notions on the design of a book, the artist book represents the process of creative thinking used to construct a work. Both visual artists and writers are involved in this new field, such as Audrey Niffenegger, who seems to be spearheading the development of it. These books can range from hand bound manuscripts consisting of traditional paper and binding to natural objects sewn together to create a new form of visual communication. The study of the artist book is of significant importance for artists and writers working in both fine art and print medias to be aware of since these books serve not only as prototypes for a manufactured product. These books are being increasingly recognized as works of art on the basis of their appearance, content and process. They offer insights into the creative experience by demonstrating how the process of writing and making images deserve just as much attention and appreciation as the finished product.

Returning to the Roots: Urban Farming and Environmentalism in Detroit

Kevin Wonch

Mentor: Dr. William Pannapacker Andrew W. Mellon Scholars Program and Department of English

During the World War II era, Detroit was referred to as "the great arsenal of democracy." Now, however, the city is currently experiencing rapid decline with uncertain outcomes. With a current population of under a million people down from over two million, little access to fresh food stores, extensive plots of vacant, tillable land, at least 60,000 unoccupied buildings, and a failing economy, there has been a recent desire to explore urban farming. The modern urban farming is a foundation for a new way of envisioning the city by using new sustainable practices to promote positive development. Drawing upon the disciplines of American studies, economics, environmental studies, history, and urban studies, I demonstrate the importance of this movement for the future of sustainable practices in the urban context, in contrast to some political and business analysts who argue against its ability to make a significant impact on the city's future.

MELLON SCHOLARS

Believing Versus Being and Living: The Correspondence Between Leo Tolstoy and Gandhi

Taylor Rebhan

Mentor: Dr. Boyd Wilson Andrew W. Mellon Scholars Program and Department of Religion

Count Leo Tolstoy and Mohandas Gandhi-a prominent Russian author and a revolutionary Hindu leader-led very different lives, yet they shared remarkably similar beliefs. While Tolstoy spent most of his life breaking away from the strict Christian Orthodox tradition in Russia, Gandhi developed his ontology primarily through Hinduism. They were, however, connected by a powerful spiritual thread: their mutual belief in Jesus' Sermon on the Mount as an incontrovertible call to a life without violence. Having read many of Tolstoy's religious writings on nonviolence, Gandhi looked to the author for guidance on its application in the sociopolitical world. From 1908 until Tolstoy's death in 1910, the two men engaged in a little-known correspondence. Today, Gandhi is renowned for advocating civil disobedience, which is rooted in the principles of nonviolence discussed in the letters. Scholars credit him with influencing leaders such as Martin Luther King, Jr., having made civil disobedience an effective method of political protest. Although those claims are valid, they often fail to recognize the importance of Tolstoy and Gandhi's intercultural and inter-religious dialogue. In my paper, I argue that the similarities between Tolstoy and Gandhi's beliefs in the Judeo-Christian concept of *agape* love and the Hindu concept of *a-himsa* were an important part of the history of nonviolent political action. I analyze this in several ways: the background of the two men, their beliefs, and the letters themselves. I then explore the long-term significance of the correspondence as seen through the effectiveness of nonviolence during the Civil Rights Movement in the United States, showing that Tolstoy and Gandhi's combined principles were accessible and practical for the movement.

Sunyata and *Kenosis*: Examining the Forms of Emptying in Buddhism and Christianity Through the State of Suffering

Chikara Saito

Mentor: Dr. Jack Mulder, Jr. Andrew W. Mellon Scholars Program and Department of Philosophy

Within the philosophy of religion, one of the most unique developments in the past century has been the Buddhist-Christian theological dialogue coupled with Eastern-Western philosophical dialogue initiated by the Kyoto School of Philosophy (a philosophical movement that emerged in the early twentieth century in Japan). In this paper, I will explore the process of emptying for Buddhism and Christianity within the philosophy of religion. Self-emptying, whether of the incarnation of Christ in Christianity or of the self in Buddhism, is foundational for the praxis of each faith tradition. There are two words that signify this emptying: in Christianity this emptyings of the self to attain non-self. Through applying the methodology of the Kyoto School of Philosophy I posit that the two visions of emptiness differ precisely in their approach toward the human state of suffering. This approach attempts to preserve the integrity of doctrine surrounding the ontological claims of the person of Christ, in marked contrast to the positions of John Hick or John Cobb, Jr., while maintaining a vocabulary that allows for genuine Buddhist-Christian dialogue. This new focus, furthermore, will be directed in response to Zen Buddhist philosopher Abe Masao's writings in the 1980s and 1990s and the brief renaissance of dialogue that ensued after those publications.

Students on the Move: Obstacles and Opportunities in the Education of Migrant Children

Miriam Hernandez, Regina Sanchez-Gonzalez and Laura Van Oss

Mentors: Professors Anna Bonnema, Amy Otis – De Grau, Yolanda Vega and John Yelding and Drs. Wayne Brouwer and Charles Green

Phelps Scholars Program

Our personal experiences and interest led us to investigate the social and educational situation of migrant families. Every year, approximately 6,000 children travel with their families to the Holland area in search of migrant agricultural work. These children face the distinct obstacles of a fragmented childhood. The education system offers a significant socializing and nurturing environment for all children. For migrant children, schooling produces unique obstacles, but can also serve as an opportunity for growth and encouragement. Through a survey of Hispanic residents and an interview with the migrant coordinator for the West Ottawa School District, we studied the influence of education on migrant children's experience. As a result, we propose that effective communication and relationships are the key to aiding migrant children in the educational challenges they face.

Optimizing the Collegiate Experience of Students with Learning Disabilities

Ann Hersey, Matthew Hughes, and Lindsay Timmerman

Mentors: Professors Anna Bonnema, Amy Otis - De Grau, Yolanda Vega and John Yelding and Drs. Wayne Brouwer and Charles Green

Phelps Scholars Program

In the U.S., only 3.6% of Learning Disabled (LD) college students graduate, while 62.1% of nondisabled students graduate. The Universal Design for Learning (UDL) can help increase the number of LD students graduating from a college or university. Universal Design for Learning is a call to institutions to support students in a variety of ways as they to strive to achieve their unique goals. When it comes to LD students, this means helping students set their goals and develop strategies for meeting them; insuring that professors acknowledge LD students and provide clarification or additional resources when necessary; increasing campus-wide awareness about learning disabilities; and providing appropriate accommodations (extended test-times, note-taking services, tutoring and other forms of academic support, etc.).

Sex-Trafficking as a Form of Slavery Today

Heather Nicholson, Clara Starr, and Maxine Terry

Mentors: Mentors: Professors Anna Bonnema, Amy Otis – De Grau, Yolanda Vega and John Yelding and Drs. Wayne Brouwer and Charles Green Phelps Scholars Program

Phelps Scholars Program

Sex-Trafficking is the most common form of modern day slavery. It is the fastest-growing business of organized crime, and the third largest criminal enterprise in the world. It is a global issue, functioning both domestically and internationally. The vast majority of those trafficked are women and children who are vulnerable due to economic and social disadvantages. Sex-trafficking businesses are becoming more and more organized and violent. Once trafficked, victims are subject to both physical and emotional abuse. They are often beaten into submission, drugged, or raped repeatedly in order to make them more compliant. Being almost entirely undercover, sex-trafficking is a crime that is difficult to find or prove.

Recognizing that slavery exists in this form is the first step in solving the issue. People who want to fight sex-trafficking should educate themselves, join anti-trafficking organizations, purchase fair-trade products, raise funds, and support rehabilitation services for those coming out of trafficking.

Why Are Asian Americans a Forgotten Sub-Culture and How Are They a Part of American History?

Haley Beck, Christopher Jones, and Allison Leigon

Mentors: Professors Anna Bonnema, Amy Otis - De Grau, Yolanda Vega, John Yelding and Drs. Wayne Brouwer and Charles Green

Phelps Scholars Program

Why do most Americans only learn about some ethnic minorities, but not others? Why are there official holidays for some groups, but not for all? How is it that an entire community—Asian Americans—can be so unrecognized for their part in American history? The perspective from which most Americans learn history is predominantly that of an affluent white American, and most of the nation views race and ethnicity primarily though a black-white paradigm. Few history books are written from an Asian American perspective. Despite this, over the last 50 to 60 years there has been an Ethnic History revival, where more and more minorities are sharing their culture and telling their stories.

There are more than twenty different nationalities under the umbrella of Asian America, so it is impossible to classify them into a single group. Each ethnic group has its own distinct culture and history. Different Asian groups came to America at different times and for different reasons. Once they were allowed into America, they found they had few rights. Discrimination against Asian Americans is rarely acknowledged by others; yet it is a common theme throughout their history, and is one of the biggest barriers in changing how others view and treat Asian Americans today.

Many stereotypes and myths exist about Asian Americans, including the most popular – the "Model Minority." The nation as a whole needs much more information about Asian Americans, and a much stronger commitment to including Asians in the national mainstream. America must define itself as what it purports to be – a nation founded on liberty and justice.

The Veto in the United Nations Security Council

Bryce Groshek, Osiris Morel, and Shubham Sapkota

Mentors: Professors Anna Bonnema, Amy Otis - De Grau, Yolanda Vega, John Yelding and Drs. Wayne Brouwer and Charles Green

Phelps Scholars Program

The United Nations (UN) was established after the Second World War to promote world peace and welfare. With six principal organs, the UN aims to facilitate cooperation in international law, international security, economic development, social progress, human rights, and the achievement of world peace. The 15-member Security Council exercises significant power within the UN, especially the five permanent members (Britain, China, France, Russia, and the U.S.) who have veto power over all resolutions. This power was granted after World War II to make sure that Japan and Germany did not retaliate against UN decisions. However, some believe that the permanent members have been too likely to exercise their veto on behalf of their own self-interest. It has been more than seven decades since the war, and this veto has been repeatedly responsible for the failure of the UN to live up to its purposes. Furthermore, in an era in which numerous countries are developing rapidly, it is no longer tenable for five countries to have the right to veto anything they want.

NATURAL & APPLIED SCIENCES BIOCHEMISTRY

CRB, a Resveratrol Analog, Reduces Cell Injury Caused by Surgery Mimicking Deep Brain Stimulation

Sara Gallemore, Abigail Lindberg, Zachary DeBruine

Mentors: Drs. Gregory Fraley, Moses Lee, Balaji Babu and Kimberly Brien Departments of Biology & Chemistry

Brain-implantable devices such as those used in deep brain stimulation (DBS) have a promising future in end-stage Parkinson's disease. However, inserting electrodes into the brain can cause astrocytic gliosis, inflammation and cell dystrophy, which is a major source of failure in chronically implantable electrodes. It is known from previous experiments that resveratrol significantly reduced tissue damage caused by DBS, however, because the metabolic half-life of resveratrol is short, an analog with longer biological activity is necessary. Our main hypothesis in this study is to test the effectiveness of CRB, a synthetic analog of resveratrol, on reducing tissue damage caused by DBS. We stereotaxically delivered CRB into the rat sub-thalamic nucleus (STN) bilaterally. We compared a 10 μ M dose of CRB to both vehicle (DMSO) microinjections and resveratrol injections aimed at the STN bilaterally (n = 8 per treatment). Rotarod testing was performed prior to surgery and 48 hours, 1 week, and 2 weeks post surgery. The animals injected with CRB demonstrated an increase in motor coordination from the pre-surgery trials similar to the animals treated with resveratrol. Both resveratrol and CRB treatment groups showed significantly (p = 0.05) improved motor coordination compared to the vehicle controls. These observations suggest that CRB is a promising treatment to prevent neuronal damage inflicted by DBS. Histological analyses will ensue to determine if the behavioral effects of CRB are due to prevention of scarring and gliosis following surgery. Data suggest that a synthetic resveratrol analog may have similar neuroprotective effects as similar to those of resveratrol itself.

Research funded by a grant from the Campbell Foundation.

BIOCHEMISTRY



Ab-Protein Sandwich Arrays to Monitor Levels of Dkk1 in Cancer Patients

David Grossens^{1,2}, Tessa Grabinski², Jacqueline Peacock², and Katie Partyka³

Mentor: Drs. Brian Haab³ and Matthew Steensma²

Hope College¹, VARI Laboratory of Musculoskeletal Oncology², VARI Laboratory of Cancer Immunodiagnostics³, Van Andel Research Institute (VARI)

The progression of osteosarcoma disease is believed to be influenced by upregulated Wnt/ β -Catenin signaling. The process involving secreted Wnt inhibitors and their function in this pathway has not been fully examined. Abnormally high levels of Dkk-1 protein have been found in patients with osteosarcoma. A member of the Dickkopf family, Dkk-1 protein is a negative regulator that is known to play a central role in the regulation of bone formation and bone resorption and appears to be directly related to disease burden. For these reasons, we established a protocol to measure levels of Dkk-1 in blood serum through optimization of a high-throughput, Dkk-1 immunoassay for analysis of samples obtained from human subjects. The purpose of this work was to develop a clinically relevant diagnostic tool to allow levels of Dkk1 protein to be monitored in post-treatment osteosarcoma patients. Future work involves the collection of sufficient quantities of serum from breast cancer patients, as well as serum from osteosarcoma patients during various stages of the treatment and recovery period, for preliminary validation of our clinical tool.

This work was supported by the Van Andel Institute through the Frederik and Lena Meijer Student Internship Program.

Invasive Spotted Knapweed Alters Insect Communities on Native Common Milkweed and May Confer Associational Resistance

Ingrid Slette

Mentor: Dr. Mark Hunter Department of Ecology and Evolutionary Biology- University of Michigan

Several aspects of the interactions between the invasive plant species spotted knapweed (*Centaurea maculosa*) and the native species common milkweed (*Asclepias syriaca*) were investigated. Our results indicate a negative direct effect, and an even greater positive indirect effect, of knapweed on milkweed. The presence of knapweed significantly altered the composition of the insect communities found on milkweed, and under certain conditions milkweed benefited from association with knapweed. Abundances of two major milkweed herbivores decreased with increasing knapweed density. Likely as a result of decreased herbivory, milkweed height and leaf number increased with increasing exposure to knapweed, indicating a positive indirect effect of knapweed had a negative direct effect on milkweed and reduced the rate of plant growth over time. These results emphasize the complexity of natural systems and of interactions between native and invasive species.

This research was funded by the National Science Foundation- Research Experience for Undergraduates.

Homocysteic Acid and Homocysteine Toxicity as a Model for Schizophrenia

Chris Davis, Guillermo Flores, and Sheri McCormack

Mentors: Drs. Chris Barney and Leah A. Chase Department of Biology

Schizophreniais a disorder that tends to strike in late adolescence and is characterized by disorganized thought, impaired memory and hallucinations. The project examined behavioral changes resulting from the introduction of homocysteic acid (HCA)and homocysteine (HC) into rats. The drugs work by inducing hypoNMDA receptor function. The objective was to determine if an animal model for the schizophrenia phenotype could be created by ablating GABA ergicinterneurons via intraperitoneal injection of homocysteic acid. Additionally, since several previous studies observed a strong correlation between elevated homocysteine levels and the development of schizophrenia, it was assessed whether hyperhomocysteinemia also leads to development of schizophrenia-like symptoms. After injections, research consisted of a series of tests used to evaluate levels of dopamine dysregulation. Our preliminary analysis suggests that increased levels of HC and/or HCA may contribute to some features of the schizophrenia phenotype.

This research was supported by NSF.
Isolation of 20 Mycobacteriophages and Genomic Analysis of the Novel Mycobacteriophage, Phineas

Maria B. Eguiluz, Mitchell R. Gage, Eric R. Hederstedt, Krista R. Hoevemeyer, Cameron F. Holder, Lize Loubser, Andrea J. Matthew, Lisa K. McLellan, Seth B. Menzer, Danielle N. Meyer, Nicholas S. North, Heather L. O'Connell, Amanda L. Porter, Amber J. Prins, Shaylyn K. Pritchard, Peter J. Schemper, Ashley S. Tiemeyer, Andrew L. Valesano, Amy L. VanderStoep, and Joshua T. Welsch Mentors: Drs. Aaron Best and Joseph Stukey Department of Biology

Twenty new mycobacteriophages capable of infecting Mycobacterium smegmatis were isolated from soil samples collected on or nearby Hope College in Holland, Michigan. Collectively, the group displayed a variety of plaque morphologies based on size, shape, and clarity, consistent with the isolation of an assortment of different phages. Both lytic and temperate phages appear represented in this collection. Purified phage stocks were used to prepare genomic DNA samples for restriction digest analysis. More than 10 distinct genome "types" were identified from the 20 mycobacteriophages. One mycobacteriophage, Phineas, was chosen for complete genome sequencing using the Ion Torrent Personal Genome Machine system platform and comparative genomic analysis. The predominant plaque produced by Phineas displayed a clear center surrounded by a turbid ring and was about 2 mm in diameter after 24 hours of incubation at 37°C. A smaller plaque (0.5-1 mm average diameter) of similar morphology was consistently observed but at a much low frequency. No further plaque growth occurred after that time. Comparison of the restriction digest pattern for Phineas with more than 200 available mycobacteriophage genomes did not yield a match or even similar result, suggesting Phineas was a novel mycobacteriophage. Genome sequence data for Phineas supported that prediction but also revealed a relationship to a rare group of mycobacteriophages defined by just two isolates. The genome of Phineas is 47.2 Kb, 67.2% GC, and contains 78 genes in agreement with the genome characteristics of closely related phage. A detailed analysis of the complete genome sequence and comparison with sequenced members of this small and unique group of mycobacteriophages is the subject of the second semester of this yearlong course and is presented. This work was supported in part by the Department of Biology at Hope College and the Howard Hughes Medical Institute's Phage Genomics Research Program.

Reproductive Success of Nestbox-Using Birds is Influenced by the Type of Pole the Nestbox is Mounted On

Kayli Horne, Spring Lake High School, Spring Lake, MI.

Mentors: Ms. Elizabeth Schanhals and Dr. Kathy Winnett-Murray Spring Lake High School and Department of Biology

Nest boxes have become a significant part of the preservation of the eastern bluebird, *Sialia sialis*. At the J.H. Campbell Complex of Consumer's Energy in West Olive, MI, the nest boxes are either mounted on smooth, cylindrical metal poles, U-shaped perforated metal poles, or chain link metal fences. Predators include snakes, other birds, raccoons, and mice. My hypothesis was that there would be higher survival rates (found by # fledged / # eggs) for the nest boxes mounted on cylindrical metal poles, because it made it more difficult for a predator to climb, and the fence and the U-shaped poles, both easier to climb, would have lower survival rates. Eastern Bluebirds, Black-capped Chickadees, Tree Swallows, and House Wrens all use the nest boxes, but tests were done without regard to species type. For the year 2011, the cylindrical metal poles yielded next boxes with a 49% survival rate for the eggs and the chain link fence yielded 40%. This 9% difference was found significant with a p value of .02 by the t-test, meaning there is only a 2% chance it is due to chance and chance alone. Comparisons between the U-shaped metal and cylindrical metal were insignificant (p=.48), as well as comparisons between the U-shaped metal and fence (p=.77). This could be due to the small sample size; few boxes were mounted the U-shaped metal. My results confirmed my initial hypothesis in part. Further research should be done for other years' data to see if a pattern emerges.

BIOLOGY



The Effects of Aquatic Insect Nutrient Subsidies on Plant Quality and Insect Herbivore Growth

Hilary Bultman,^{1*} David Hoekman,² Jamin Dreyer,² and Claudio Gratton²

Mentor: Dr. Kathy Winnett-Murray¹

¹Department of Biology, Hope College

²Department of Entomology, University of Wisconsin, Madison

Cross ecosystem nutrient subsidies such as mobile organisms have been shown to directly enrich plants which may indirectly influence herbivores and predators. For example, herbivorous insects may grow larger or faster on plants that have been fertilized by emergent aquatic insects. We conducted a survey of July Highflyer larvae (Geometridae: *Hydriomena furcata*) on willows (Salicaceae: *Salix phylicifolia*) at 4 sites near Icelandic lakes with high or low midge (Diptera, Chironomidae) emergence. After accounting for differences between individual plants and sites, caterpillar leaf shelter density was 4 times higher at the high-midge than low-midge sites. We hypothesized that cross-ecosystem subsidies in the form of midge carcasses fertilize nearshore plants at high-midge sites, resulting in larger herbivores. We conducted an experiment, with field and lab components, where caterpillars were transplanted from and reared on willow from the high and low-midge sites. Larval mass did not differ between caterpillars reared in the lab regardless of the origin of caterpillars or willow. In our field experiment, pupae transplanted to willows at high-midge sites were heavier than those at low-midge sites. Our findings indicate that cross-ecosystem subsidies in the form of aquatic insects can influence the prevalence and mass of insect herbivores in recipient ecosystems.

This research was supported by the National Science Foundation.

Environmental Enrichment Devices Decrease Feather Picking in Commercially Raised Pekin Ducks

Sarah Colton

Mentor: Dr. Gregory S. Fraley Department of Biology

Commercial Pekin ducks housed on raised plastic flooring exhibit higher levels of self-picking than those raised on litter flooring. This self-picking can lead to reduced feather quality and poor overall health of the bird. The connection between the flooring type and the feather quality is believed to exist because ducks on raised plastic flooring cannot exhibit foraging behaviors as they do on litter flooring, thus predisposing the ducks to increased feather picking when transitioning from down to adult plumage. Thus we hypothesized that giving Pekin ducks environmental enrichment devices (EEDs) would decrease feather picking and improve feather quality and duck well-being. To test this hypothesis, we offered a substitute outlet for foraging behavior by providing EED's. The EED's were red wiffle balls, each threaded with four zip-ties. The zip ties were either red or white to help determine if the ducks have a color preference. The EED's were placed in barns holding with two pens of ducks, each pen holding 4000-6000 ducks from about fourteen days of age until processing at around thirtyfive days of age. One half of each barn received the EEDs, the other half was used as control, thus minimizing management differences across barns. A total of 6 barns were used in this study and there were approximately 120 ducks per EED. Upon placement of EEDs, each side of the barn was observed for one hour and also video taped for another hour. These observation periods occurred twice between days 14-35. Results showed a significant (p<0.05) decrease in both self-picking and conspecific-picking (picking at neighboring ducks), and a slight, though not significant, preference for red-colored EED's over white ones. These results suggest that providing environmental enrichment may minimize prevent feather picking and improve feather quality and duck well-being.

This research was funded my Maple Leaf Farms, Inc.

Biological and Chemical Study of Apios (Groundnut)

Jeff Corajod, Austin Homkes, Jim Tufts and Holly Vander Stel

Mentor: Drs. Kenneth Brown and Jianhua Li Departments of Biology and Chemistry

Apios is a genus of herbaceous vines found in North America and Asia. The plant has characteristic edible tubers which are said to contain the chemicals genistein and resveratrol as well as high levels of protein. The genus may be broken up into 6-8 species, two which are found in North America and the rest found in southwest Asia. Of the American species, *A. americana* is quite unique in the fact that it can be found as either diploid or triploid which are almost visually indistinguishable. The triploid populations are found in the northern growth range for the species while the diploids are found in the south. The goal of the study was to determine the presence and concentration of protein, genistein and resveratrol in the plants, to create a phylogenetic tree of the genus, to investigate the distribution of diploid and triploid *A. americana* and attempt to create a method to differentiate the diploid and triploid plants through their stomata guard cell size. It was found that genistein can be detected in most structures of the plant although the concentration is highest in the tuber cortex. Phylogenetic trees for the genus were created using DNA sequences from the plastid gene matK and the nuclear gene ITS. The trees differ as the matK tree groups one Asian species, *A. fortunei*, as being more closely related to North American species whereas the ITS tree groups *A. fortune* as being more closely related to the other Asian species. Finally, data was collected to investigate the relationship between stomata guard cell length and ploidy level. Triploid have slightly longer guard cells on average, but the relationship is not statistically significant.

This research was supported by the Howard Hughes Medical Institute.

Fasting Reduces Luteinizing Hormone Secretion in the Pekin Drake, Part I: Localization of and Effects of Fasting on Galanin-Like Peptide Expression in the Hypothalamus

Elizabeth Gerometta, Erika Coombs, Abigail Lindberg, Sara Gallemore and Sarah Colton

Mentor: Dr. Gregory S. Fraley Department of Biology

Pekin ducks are seasonal breeders that are also very sensitive to nutritional status. It is known that fasting reduces reproductive hormone secretion, however the neurobiology underlying this effect is not clear. The purpose of this study was to first confirm that fasting reduces plasma luteinizing hormone (LH) levels in male ducks. Second we set out to determine if the reduced LH levels were associated with changes in the hypothalamic expression a neuropeptide that is known to regulate feeding and reproduction, galanin-like peptide (GALP). Groups of adult male Pekin ducks (~60 weeks of age) were either fed or fasted for 17, 24 or 48 hours (n = 6 per group). At the end of each time point, drakes were euthanized by cervical dislocation and blood collected for plasma determination of LH levels. Brains were removed and processed for immunocytochemical detection of fos- and GALP-immunoreactivity (ir). Circulating LH levels were significantly (p < 0.05) reduced after 24 hrs of fast. A significant increase (p < 0.01) in fos-ir was found in the hypothalamic paraventricular nucleus (PVN) in fasted drakes compared to fed controls. In fed drakes, GALP-ir was localized to the infundibular nucleus (INF), the avian analog to the arcuate nucleus. There was virtually a complete loss of GALP-ir in the INF) in fasted compared to fed drakes. These data suggest that GALP neurons stimulate LH secretion and GALP peptide expression is regulated by metabolic state.

This research was supported by the Hope College REACH and NSF REU Programs (Biology Department), NSF-MRI, the Howard Hughes Medical Institute, and Maple Leaf Farms, Inc.

Fasting Reduces Luteinizing Hormone Secretion in the Pekin Drake, Part II: Localization of and Effects of Fasting on Gonadotropin-Inhibitory Hormone Expression in the Hypothalamus

Erika Coombs, Elizabeth Gerometta, Sarah Colton, Sara Gallemore, and Abigail Lindberg

Mentor: Dr. Gregory Fraley Departments of Biology and Neuroscience

Pekin ducks are seasonal breeders that are also very sensitive to nutritional status. It is known that fasting reduces reproductive hormone secretion, however the neurobiology underlying this effect is not clear. The purpose of this study was to first confirm that fasting reduces plasma luteinizing hormone (LH) levels in male ducks. Second we set out to determine if the reduced LH levels were associated with changes in the hypothalamic expression of a neuropeptide known to regulate feeding and reproduction, gonadotropin inhibitory hormone (GnIH). Groups of adult male Pekin ducks (~60 weeks of age) were either fed or fasted for 17, 24 or 48 hours (n = 6 per group). At the end of each time point, drakes were euthanized by cervical dislocation and blood collected for plasma determination of LH levels. Brains were removed and processed for immunocytochemical detection of fos-, and/or GnIH-immunoreactivity (ir). Circulating LH levels were significantly (p < 0.05) reduced after 24 hrs of fast. As with all other avian species, GnIH-ir was localized to the hypothalamic paraventricular nucleus (PVN). A significant increase (p < 0.01) in fos-ir was found in the PVN in fasted drakes compared to fed controls. Many of the fos-ir neurons within the PVN also colocalized GnIH-ir. These data suggest that GnIH neurons are important mediators between the feeding and reproductive systems in Pekin drakes.

Investigating the Cytotoxic Effects of Mycobacteriophage Vix Gene 80

Danielle Goodman

Mentors: Drs. Joseph Stukey and Virginia McDonough Department of Biology

A bacteriophage, or phage, is a type of virus that infects and replicates in bacteria. To reproduce, the infecting phage must convert the host cell metabolism from that suited for cell survival to one favorable for producing new phage progeny. One mechanism by which phage can cause host cell conversion is by expressing 'cytotoxic' phage gene products that interact with and inhibit the function of specific protein targets of key metabolic pathways of the bacterial host. Identifying 'cytotoxic' phage genes and understanding more about how phage exploit their host's weaknesses could lead to new and important therapies for many bacterial illnesses. In this work, a cytotoxic gene from mycobacteriophage Vix, gene 80, was studied. The protein of the Vix80 gene is 68% identical to the product of gene 77 of mycobacteriophage L5, a gene that has been shown to be cytotoxic to *Mycobacterium*. In work not published, I confirmed that the Vix80 gene product is also cytotoxic when expressed in *Mycobacterium smegmatis*. My hypothesis is that a physical interaction between the Vix80 gene product and a specific host cell protein affects cell metabolism and causes growth inhibition. My summer research goal was to test that hypothesis and work toward identifying the targeted host cell protein. Using molecular biological techniques, I tagged the N-terminus of the Vix80 protein with six histidine residues. The modified protein was then expressed in *Escherichia coli* and purified by column chromatography. SDS-PAGE and staining verified that I had expressed and purified the Vix80 protein in a biochemical approach to identify the interacting host cell protein.

This research was supported in part by the American Society of Biochemistry and Molecular Biology.

The Maintenance of Reproductive Status in Pekin Drakes Requires Both Red and Blue Wavelengths of Light: Relationship to Opsin-Related Proteins in the Hypothalamus

Rachel Haas

Mentor: Dr. Gregory S. Fraley Department of Biology

In birds there is compelling evidence that photoresponsiveness is mediated – at least in part – by neurons that express photosensitive chemicals. These neurons have been referred to as deep encephalic photoreceptors. Photo-responsive pigments all consist of an opsin protein that is a transmembrane, G-couple receptor that transduces light energy into a neuronal signal. Two of these opsin-related proteins, opsin and melanopsin, have been identified in avian brains. Pekin ducks are seasonal breeders and as such, very sensitive to artificial and natural light. The purpose of these studies was to determine if specific wavelengths of light are necessary to maintain plasma luteinizing hormone secretion and to determine the hypothalamic circuitry underlying this effect. First, drakes were exposed to full spectrum, white light or red (~625 nm) or blue (~400 nm) specific wavelengths and blood samples take at intervals around lights on (0300 hrs). We found that neither the read nor blue wavelengths of light could maintain circulating LH levels compared to that of drakes housed under white light. Second, drakes housed under white lights were euthanized and brains processed for immunocytochemstry for opsin and melanopsin. As in other species, opsin-ir (RET-P1) was found in the lateral septal area (LS) and infundibular nuclei (INF) and were colocalized with vasoactive intestinal polypeptide. Melanopsin-ir was observed in the premammillary nucleus (PMM) and colocalized with tyrosine hydroxylase. Immunoreactive fibers for both opsin- and melanopsin were observed throughout the diencephalon and found to be in close contact with GnRH cell bodies. Third, a significant (p<0.01) increase in fos-ir was observed in all three nuclei in drakes exposed to white light compared to dark conditions. These data suggest that multiple opsin-related peptides within the diencepahlon are necessary to maintain photoresponsiveness in Pekin drakes.

BIOLOGY

Fer Kinase is Required for Hematopoietic Development in Zebrafish

Elizabeth Billquist, Jessica Kozack and Erin Hildebrandt Mentor: Dr. Aaron Putzke Department of Biology

Fer kinase, a protein involved in the regulation of cell-cell adhesion and proliferation, has been implicated in leukemia, gastric cancer, and liver cancer. However, the role Fer plays in the molecular mechanisms of these diseases is largely unknown. By studying the role that Fer plays during development, we hope to obtain a better understanding of its involvement in carcinogenesis. Our lab has shown that FRK-1, a Fer kinase homologue in *C*. elegans, is involved in stem cell regulation. In this project, we begin to bridge the gap between the invertebrate and vertebrate realms by elucidating the role that Fer kinase plays in zebrafish embryogenesis. Our data indicate that not only is a Fer homologue expressed during zebrafish embryogenesis, but that it is also required for normal hematopoiesis. These results have led us to hypothesize a novel role for Fer as a regulator of either definitive hematopoiesis or the Runx1 pathway.

This material is based upon work supported by the Nation Science Foundation funded REU (0754293) and the Howard Hughes Medical Institute undergraduate fellowship.

Antifungal and Antileishmanial Properties of Tropical Pioneer Plant Seeds

Erica Jansen

Mentors: Drs. Greg Murray and Aaron Best Department of Biology

Seed extracts of three species of Costa Rican pioneer plants with persistent seed banks were tested for anti-parasitic activity against *Leishmania tarentolae* and antifungal activity against *Pythium irregulare, Fusarium oxysporum* and *Saccharomyces cerevisiae* with bioassays analyzing organism viability at various concentrations of extracts. *Bocconia frutescens* was highly toxic to *Leishmania* and *Saccharomyces,* but *Guettarda poasana* and *Phytolacca rivinoides* were not. *Bocconia* extract was not toxic to a mammalian cancer cell line (B16), suggesting potential therapeutic value for treatment of human parasitic and fungal infections. This work points to the value of using ecological patterns to guide bioprospecting for pharmaceutically promising compounds from tropical rainforest plants.

Abstract Restricted

This work was supported by the Hope College Department of Biology Dean's Office.

Influence of Endophytic Fungi Infecting Tall Fescue on Parasitoid Performance

Sherri Smith

Mentor: Dr. Thomas L. Bultman Department of Biology

Neotyphodium coenophialum (Ascomycota: Clavicipitaceae) is an endophytic fungus that lives symbiotically within the stems, leaf sheaths, and seeds of its host grass, tall fescue (*Lolium arundinaceum*) and produces toxic alkaloids that are deterrents to herbivores by negatively impacting growth, development, and survival. These negative impacts may be carried over to natural predators of the herbivores. In this study, my objective was to examine if *Neotyphodium* in the diet of aphids, *Rhopalosiphium padi*, affect the performance of their parasitoid, *Aphidius matricariae*, by means of survival rate, developmental time, body mass, and size. Aphids were fed either tall fescue infected with or lacking the endophyte and then parasitoids were allowed to parasitize the aphids. Although not statistically significant and contrary to predictions, parasitoids reared on aphids fed infected tall fescue actually tended to have greater survival rates, shorter developmental times, and greater mass and tibia lengths then their E- treatment counterparts. The results suggest that consumption of endophytic grass may not have a negative impact on parasitoid performance.

This material is based upon work supported by the National Science Foundation-Research for Undergraduates program.

Pond-Specific Dynamics of Fish at the Outdoor Discovery Center and the Influence of Predatory Fish on Species Interactions

Matthew Smith, James DelBene, Kelly Krueger, Marissa Martz, Jacob VanderYacht and Joseph VanderYacht Mentor: Dr. Kathy Winnett-Murray Department of Biology

Micropterus salmoides (largemouth bass) are the most common piscivorous fish in North American fresh water bodies and have been shown to have profound effects on the growth patterns of their prey species. Species composition, size and age distribution of bass and Lepomis species (green sunfish, pumpkinseed sunfish, bluegill and hybrid sunfish) were determined in 5 stocked ponds at the Outdoor Discovery Center /Macatawa Greenway of Holland, Michigan. Human-created ponds are becoming more common in this region, and we hoped to understand bass-prey interactions in ponds of varying characteristics. The average lengths of all Lepomis species were about 3.5cm (130%) longer in ponds with bass than in ponds without bass, suggesting a decrease in competition and selection favoring faster growth rates. However, in ponds with few or no bass, there was greater species richness of the Lepomis sunfishes. Pumpkinseeds appear to be the most successful in coexisting with bass; only a small decrease in population size of pumpkinseeds was measured in ponds with bass, and this may be related to behaviors and/or habitat use that most effectively limits detection by bass. The average age of Lepomis in ponds with bass was higher than in ponds with no bass, 4.098 years and 3.333 years, respectively. Hybrid sunfish, known for their hardiness for cold, unfavorable water conditions, had the oldest mean age of all prey species: 4.875 years in ponds with bass, 3.214 years in ponds without bass. Overall, there was a greater mean age, weight and length of Lepomis prey species when co-occurring with bass. In conclusion, bass appear to have a significant impact on the growth dynamics and species composition of these human-created ponds. Future research will explore in more detail how that impact may be mediated by physical attributes of the ponds (e.g. size, depth, etc.).

This research was supported by Hope College Biology Department and Outdoor Discovery Center/Macatawa Greenway.

The Role of Nro1p in Recognition and Signaling the Presence of Dietary Unsaturated Fatty Acids

Marshall Willey

Mentors: Drs Joseph Stukey, and Virginia McDonough Department of Biology

The *OLE1* gene in *Saccharomyces cerevisiae* encodes the sole fatty acyl desaturase in that species. *OLE1* gene expression is controlled in part through transcriptional regulators Mga2p and Spt23p. These proteins reside in the ER, and when insufficient supply of unsaturated fatty acids (UFAs) is detected, they are proteolytically cleaved and translocated into the nucleus, where they activate *OLE1* expression. Recently our lab has isolated a mutant that is deficient in regulation of *OLE1*, called *nro1* (*no* regulation of *OLE1*). The mechanism for the *NRO1* protein's action is unknown. In this study, we report that growth tests using a reporter gene under control of the *OLE1* promoter demonstrate that in wild type cells, normal regulation is observed with the UFAs 16:1 Δ 9 and 18:2 Δ 9, 12 but not with UFAs 18:1 Δ 9 or 17:1 Δ 9. Fatty acid profiles of *nro1* mutant cells are similar to wildtype when cells are supplemented with the various UFAs, showing evidence of intact post-transcriptional regulation. Preliminary results examining the effect of *nro1* on the proteolytic treatment of Mga2p and Spt23p through western analysis are presented. Taken together, there is evidence that the *NRO1* system helps regulate *OLE1* expression in response to fatty acids 16:1 Δ 9 and 18:2 Δ 9, 12, but not 18:1 Δ 9 or 17:1 Δ 9.

Determination of Putative DNA Binding Sites for Virulence Factor RegR in Streptococcus

K.A. Shades Mentor: Dr. Aaron Best Department of Biology

Recently developed bioinformatic software is currently being used to predict the specific site at which a transcription factor (TF) binds to DNA. TFs are regulated to activate genes on DNA, which subsequently promotes their translation into proteins. In this study selected transcription factor binding sites (TFBS), as predicted by the online program RegPredict, will be verified for the TF RegR. After obtaining the purified RegR protein from *Streptococcus*, an Electromobility Shift Assay and Fluorescence Polarization will be used to reveal the binding affinity of RegR to each TFBS. Importantly, RegR is predicted to regulate the gene encoding hyaluronidase (*hylA*). This enzyme is involved in the degradation of hyaluronic acid, which is found on the surfaces of some human tissue cells. Without this coat the virulence of pathogenic agents increases and human diseases like meningitis or septicemia are more likely to occur. The validation of the protein RegR as a TF for *hylA* has potential significance in the development of pharmaceutical products that alter its binding properties, decreasing the likelihood of disease caused by *Streptococcus*.

Carbon-carbon Single Bond Activation of Quinolinyl Ketones: The Varying Effects of Substitutions

John M. Zona Mentor: Dr. Jeffrey B. Johnson Department of Chemistry

Carbon-carbon single bonds are some of the most inert and stable bonds in chemistry. Very few methods have been shown to break a carbon-carbon single bond, a process also described as activation. One method that has been shown to activate a carbon-carbon single bond uses a rhodium catalyst, and follows activation with an insertion of an alkene between the carbons (*J. Am. Chem. Soc.*, **2009**, 131, 412-413). This research seeks to further understand the underlying mechanism of the reaction in hopes of expanding its usability in organic synthesis. Substrates were prepared with substitutions along the aromatic ring, and alkene chain. These new substrates were utilized in kinetic studies performed using ¹H NMR to determine the effects of substitution on the rate of the carbon-carbon single bond activation reaction.

This research was supported by the Research Corporation under award number 7833 and by the ACS-Petroleum Research Fund under award No. 50347-UNI1.

Extending the Range of Sequence Recognition of the Hx DNA Binding Unit

Michael Bowerman, Andrew Mepham

Mentors: Dr. Balaji Babu, Dr. Kimberly Brien, Dr. Vijay Satam, Dr. Moses Lee Department of Chemistry

Previous work by this group has reported a *p*-anisylbenzimidazolecarboxamido (Hx) moiety that has been incorporated as a fluorophore in imidazole (I) and pyrrole (P)-containing polyamides. The Hx-core behaves like a two consecutive pyrrole units (P-P) and it targets AT rich sequences. However, Hx-polyamides are not able to target DNA sequences rich in GC base pairs. In an effort to develop fluorescent molecules that are capable of binding GC-containing sequences, analogs of Hx were designed and synthesized. Results from these studies will be presented.

Transforming the Vibrational Hamiltonian of a Polyatomic Molecule Using Van Vleck Perturbation Theory

Andreana Rosnik

Mentor: Dr. William Polik, Hope College Department of Chemistry

The goal of analyzing vibrational levels of polyatomic molecules with Van Vleck perturbation theory is to connect experimental and theoretical approaches for determining molecular potential energy surfaces. Chemists model reactivity of molecules along potential energy surfaces, which are functions of the internal coordinates of the molecule. Vibrations move along these coordinates, so measuring vibrations experimentally characterizes the potential energy surface. Vibrational energy levels are calculated from a quartic potential function via Van Vleck perturbation theory, a procedure that approximately diagonalizes the vibrational Hamiltonian. The matrix elements of the transformed Hamiltonian have been derived, and some of the equations are presented. A new computational technique, VPT2+K, will be defined by these results and used to calculate vibrational states.

This research was supported by the Dean of Natural and Applied Sciences.

Hx, A New DNA Sequence Recognition Moiety: Design, Synthesis, and DNA Binding Investigations

Jeffrey Sweers

Mentors: Drs. Kimberly Brien, Vijay Satam, Moses Lee Department of Chemistry

Even though pyrrole (P)- and imidazole (I)- containing polyamides have been shown to bind AT-rich sequence via the minor groove of DNA with high affinity and specificity, the ability to track the movement of these molecules in cells or in an animal has been a challenge. The solution to these hurdles is the introduction of the *p*-anisylbenzimidazole-carboxamido (Hx) moiety, producing a molecule that not only fluoresces under ultraviolet light (322 nm) but also contributes to binding affinity and sequence specificity. The Hx structure demonstrates sequence specificity similar to that of two adjacent pyrrole unit or P-P. The Hx-containing polyamides showed increased binding affinity relative to N-terminal P-P-polyamides. In order to push the absorbance of Hx-polyamide to longer wavelength highly conjugated fluorophores are being engineered into the Hx moiety. Results from these studies will be presented.

Investigation of Drug-Nanoparticle Interactions by Isothermal Titration Calorimetry

Lydia Rau

Mentors: Drs. Michael Seymour and Jonathon Peterson Departments of Chemistry and Geological and Environmental Sciences

Prescription drug usage has increased in recent decades in the United States. In 2009, the most-prescribed drug was the painkiller Vicodin, with 128.2 million prescriptions. Drugs are also used in animal husbandry to increase yields of products. When these prescriptions are ingested, the body does not use the entire amount of drug and the excess is excreted. The levels of excreted drugs that ultimately reach municipal treatment facilities are low enough that bacteria at the wastewater plants do not effectively break them down. Therefore, the drugs leach into groundwater and have deleterious effects, even at such low levels. Microbes are inoculated against the effect of antibiotics, while hormones from birth control pills can cause hermaphroditic fish.

Nanoparticles are materials with dimensions between 1 and 100 nanometers (10^{-9} meter). In addition to natural sources, their use in products such as sunscreen, paint, and stain-resistant clothing is increasing their occurrence in the environment. Since nanoparticles have a large surface area to volume ratio, it is hypothesized that drugs will bind to these particles. Such binding could have an effect on the movement of pharmaceuticals through groundwater or might facilitate breakdown of the drug.

This project uses isothermal titration calorimetry (ITC) to evaluate the strength of binding between selected drugs and nanoparticles. ITC uses an adiabatic two-cell system and measures the energy needed to keep the cell where the reaction occurs at the same temperature as the reference cell. This energy is related to the reaction between the drug and the nanoparticle and the enthalpy (Δ H) of the reaction. Through careful control of the stoichiometry and reaction conditions, it will be possible to quantitatively evaluate the nature of these nanoparticle – drug interactions.

This research was supported by the Hope College Chemistry Department Undergraduate Research Fund (Rau) and the Matthew & Anne Wilson Faculty Development Fund (Peterson and Seymour).

Sediment Fingerprinting of Lake Macatawa using PIXE and SEM/EDS

Kyle Alexander and Lauren Zandstra Mentor: Dr. Graham Peaslee Department of Chemistry

The settlement and development of the Holland/Zeeland area has led to soil erosion and the current eutrophic state of Lake Macatawa. As part of the Macatawa Watershed Project, two complementary elemental analysis techniques have been developed to analyze sediment from the surrounding watershed: Scanning Electron Microscopy/Energy Dispersive Spectrometry (SEM/EDS) and Particle Induced X-Ray Emission (PIXE). By combining SEM/EDS and PIXE, a detailed elemental analysis can be obtained of both light and heavy elements. Suspended sediment samples were collected throughout the watershed after a significant rainfall has occurred using sediment traps. Preliminary results from the SEM/EDS and PIXE analyses, demonstrate that there is elemental variation between sites, as well as between sample collections; these results are reproducible and have been supported by analysis of sediment phosphate content. The ultimate goal of this project is to develop a signature that is characteristic of specific sediment sources within the watershed, so that the non-point-source sedimentation that occurs now can be traced to its origins in future years.

This research was supported by the National Science Foundation, Macatawa Area Coordinating Council, Outdoor Discovery Center, and State of Michigan DNRE (WQM)

Exploring the Cytoxicity of Silica Coated Water-Soluble CdSe Nanocrystals

Elly Earlywine Mentor: Dr. Graham Peaslee Department of Chemistry

For this study, red-emission CdSe quantum dots were prepared and their cytotoxicity was tested. In order for hydrophobic CdSe quantum dots to be used in biological studies, they need to be coated with a water-soluble, nontoxic shell such as ligands, polymers, or silica. Using the standard pyrolysis of organometallic reagents, CdSe quantum dots were prepared and coated with a silica shell by a reverse microemulsion method. UV-Visible absorption spectroscopy and transmission electron microscopy were used to determine the characteristics of the quantum dots prepared. The CdSe quantum dots were approximately 4.4nm in diameter. An MTT (3-[4,5-dimethylthiazol-2-yl]-2,5-diphenyltetrazolium bromide) colorimetric assay was performed in HELA cells to determine the cytotoxicity of the CdSe quantum dots. Toxicity of the CdSe quantum dots were more cytotoxic than the 605 ITK amino quantum dots. Improvements in the silica coated quantum dots needed to be accomplished before their cytotoxicity can be fully tested.

The Macatawa Watershed Project: Fecal Contamination and Microbial Source Tracking

Angela J. Aumaugher, Andrea J. Houg, Eric S. Hydorn, Rosa E. Reyes, Hannah E.H. Reynolds, Nick Pikaart, Sangeetha Srinivasan

Mentor: Dr. Michael J. Pikaart Department of Chemistry

Beach closures have become a recurring problem in Ottawa County and surrounding areas. The State of Michigan monitors water quality by measuring viable E. coli levels. However, current methods require at least 18-24 hours in order to yield results, delaying decision making regarding beach closures and increasing public health risks. These methods also do not differentiate between various sources of fecal contamination. Microbial source tracking methods using molecular tools have recently been developed to give information about the source of the contamination. This project, involving the Lake Macatawa watershed, uses viable colony count of E. coli and enterococci as well as PCR and qPCR to probe for host specific fecal markers. Preliminary assays detected little contamination from human sources. Research is ongoing to investigate possible animal sources, including bovine and swine sources.

Construction of Green Fluorescent Protein Inducible Promoter for Use in gal1/gal10 Activation Studies in Yeast

Rachel K. Doud, Jamie L. Grit Mentor: Dr. Michael J. Pikaart Department of Chemistry

Gene regulation refers to a cell's ability to turn specific genes on and off. In yeast cells, different genes can be expressed depending on the type of carbohydrate source available. The focus of this project was to create a plasmid containing an inducible promoter region that could be used for gene regulation studies in yeast. Restriction digests were performed to isolate a green fluorescent protein (GFP) gene controlled by the gal1/gal10 promoter region which was inserted into two different plasmids, pRS416 and pYEUra3. These plasmids were transfected into YPH499, a strain of Saccharomyces cerevisiae and were then grown in a selective medium. The promoter region was manipulated by introducing the cells to either a galactose or glucose rich environment. Cell fluorescence was observed using fluorometry and fluorescent microscopy, and images of the cells were taken using the Apotome microscope. Due to large amounts of auto fluorescence in all of the YPH499 cells, a different strain, Y294, was recently transfected with the GFP plasmids and will be used for further gene regulation and fluorescent microscopy studies.

Carbon-carbon Bond Activation: A Kinetic Study of Varying Substrates with Rhodium Catalysis

Casey E. Baxter Mentor: Dr. Jeffrey B. Johnson Department of Chemistry

Carbon-carbon sigma bonds are known to be very stable under most reaction conditions; however, through the use of organometallic chemistry, specifically with rhodium catalysis, we have successfully been able to activate carbon-carbon bonds in quinolinyl ketones and have consequently been able to propose a mechanism for the reaction (*JACS*, **2009**, *131*, 412 and *JACS*, **2011**, *133*, 2031).

Current work has involved expanding the reaction to a variety of substrates by functionalizing one the aromatic rings of the parent quinolynl ketone. Following synthesis of the desired analogs, each is subjected to the carboacylation reaction. Reactions are run in re-sealable NMR tubes and can be performed with as a single reaction with one substrate or a competition reaction with two of the substrates reacting within the same tube. Through analysis of the NMR spectra, we are able to determine the rate of the reaction and ascertain how the functional groups affect the rate. Two different catalysts, Wilkinson's catalyst and rhodium bis(ethylene) are used during the reaction process and results from these experiments will be presented. Future work will involve continued data collection as well as more extensive rate analysis.

This research was supported by the Research Corporation under award number 7833.

Tailoring and Characterizing Surface Properties

Christopher Beaudoin, Alexandra Benson, and Meagan Elinski

Mentor: Dr. Mary Anderson Department of Chemistry

Molecules and nanomaterials can be assembled on surfaces in order to build complex structures and devices from the "bottom up". To serve as the foundation for these architectures, surfaces are patterned via microcontact printing, a process that directs the adsorption of self assembled monolayers. Microcontact printing uses a polydimethylsiloxane stamp in a process analogous to the use of a rubber stamp. We have developed a protocol to mold stamps from surfaces generated by traditional lithographic techniques. Patterned self assembled monolayers can direct the assembly of metallic nanoparticles, as well as the nucleation of calcium carbonate crystals. Self assembled monolayers can be characterized by contact angle goniometry, a technique which looks at the angle of a drop of solvent on the surface. The contact angle is dependent on the intermolecular interaction between the solvent and the surface allowing the surface energy to be calculated. Information about the surface energy as well as wettability can be utilized to indicate the quality of a self assembled monolayer as well as its' surface reactivity. Scanning electron microscopy is also used to characterize chemical patterns as well as the assembly and characterization techniques to assemble nanowires into more complex structures.

Hope College Startup Fund

Synthesis, Characterization, and Directed Assembly of Nanoparticles

Alexandra S. Benson, Christopher K. Beaudoin, and Meagan B. Elinski Mentor: Dr. Mary E. Anderson Department of Chemistry

Nanoscience is the study of structures having at least one dimension that is less than 100 nm. Herein, these structures are fabricated by synthetic routes for specific single metal (i.e. Ag, In, Sn, Bi) and intermetallic (i.e. PtPb, $InSn_4$) nanoparticles. In this work, a modified polyol process was utilized, which employs sonochemistry and chemical reduction both with and without the use of polymer stabilizer. The products of the syntheses were characterized using X-ray diffraction spectroscopy, scanning electron microscopy, and energy dispersive X-ray spectroscopy. Functionalization of the nanoparticles with self-assembled monolayers was attempted using various organic ligands (i.e. phosphonic acids, alkanethiols), and the effects of this attempted surface modification was investigated using directed assembly via microcontact printing. Initial data indicates that the nanoparticles show selectivity with or without functionalization, possibly due to the effect of drying in the assembly process. In the future, the use of different solvents and methods for directed assembly will be investigated to optimize the procedure. It is an ultimate future goal to study the orthogonal assembly of nanoparticles and other nanostructures in order to construct greater hierarchical structures to be applied for use in areas such as medical diagnostics and solar power technologies.

This research was supported by Hope College Chemistry Department Start-up funds.

Palladium-Catalyzed β-Carbon Elimination of Fluorinated Triarylmethanols

James R. Bour and Jacob C. Green Mentor: Dr. Jeffrey B. Johnson Department of Chemistry

Due to their stability, carbon-carbon δ -bonds are inert under a vast majority of reaction conditions. Recently, however, methods have been developed for the activation of such species through the use of transition metal catalysts. The palladium catalyzed β -carbon elimination of triarylmethanols is an example of such a methodology (Miura et. al. *J. Org. Chem.*, **2003**, *68*, 5236). The presented research describes the mechanistic investigation of this palladium-catalyzed reaction, specifically the influence of fluorinate triarylmethanols on the rate and selectivity of C-C bond activation. Fluorine substituted triarylmethanols were chosen because of the sterically unhindered and electronically active nature of fluorine, which has been hypothesized to participate in an agostic-type interaction with the metal center to enhance intermediate stability. Analysis of the product ratios and yields generated data to help elucidate the mechanism by which this reaction proceeds and provide additional insight into the factors that influence carbon-carbon bond activation.

This material is based upon work supported by the ACS Petroleum Research Fund under grant No. 50347-UNI1 and the ACS Division of Fluorine Chemistry.

Historical Trace Metal Profile of Lake Michigan Sediment

Dan Anderson, Bailey Bensley and Dave Nowicki Mentor: Dr. Graham F. Peaslee

Department of Chemistry

Trace metals occur naturally in the environment, but elevated levels of trace metals can indicate anthropogenic influence. By analyzing lake sediment cores as a function of depth, historical anthropogenic effects in the surrounding watershed can be determined. Multiple ~50 cm cores were taken from a 65 m depth contour in southeastern Lake Michigan and were separated into centimeter segments and dried, then a subset of cores were radiodated using ²¹⁰Pb and ¹³⁷Cs. Three separate analytical techniques (Particle-Induced X-ray Emission Spectrometry - PIXE, Scanning Electron Microscopy- Energy Dispersive Spectrometry – SEM/EDS and Inductively-Coupled Plasma Optical Emission Spectroscopy - ICP-OES) were used to measure metals on several full cores, and a trace metal profile was assembled as a function of depth and date. The resulting metal profiles will be used to identify trace metals in the lake sediment as well as their origins. Additionally the comparison between the three different analytical techniques of PIXE, SEM-EDS and ICP-OES will give insights on the limits of detection and the acid-elution factors that are routinely used in sediment metal analyses.



Preparation of Ferrocene-Based Redox Mediators for Use in Glucose Sensors

Andrew E. Cook, Zachary J. Beswick and Kyle S. Brubaker

Mentors: Drs. Elizabeth M. Sanford and Kenneth L. Brown Department of Chemistry

Diabetes is a disease that affects millions of Americans and is a major health concern for our country. It is characterized by the body's inability to properly use insulin to regulate blood glucose levels. To control their diabetes medically, patients must monitor blood glucose levels using an internal or external glucose sensor. The goal of this research is to improve the sensitivity and quality of these devices by preparing novel redox mediators that can be electropolymerized on the surface of electrodes used in glucose sensors. The redox mediators join a ferrocene to a thiophene so that the iron-based ferrocene, responsible for the redox chemistry, can be attached to an electrode via the thiophene portion. The synthesis, electropolymerization, and characterization by cyclic voltammetry of these compounds is presented as well as initial glucose sensing studies.

Extending the AMBER Force Field to Describe Fluorescent Probes

Andrew E. Cook, Arcelia S. Ortega, Alyssa M. Stevenson, Derek W. Summers, Alyssa A. Cassabaum, Christine A. Gobrogge, Bryan A. Leland, David A. Paul, and Amy L. Speelman Mentor: Dr. Brent P. Krueger Department of Chemistry

We are developing a method for studying the structural dynamics of biomolecules, which couples fluorescence spectroscopy and computational modeling, providing a more complete understanding than is possible with either technique alone. The computational modeling will be based primarily on molecular dynamics (MD) simulation. Before running MD, dye parameters were determined that are consistent with the Cornell et al. force field (1995, *J. Am. Chem. Soc.*) and the generalized AMBER force field (GAFF; Wang et al., 2004, *J. Comput Chem.*) commonly used in AMBER. Parameterization was carried out using quantum mechanical calculations to determine low-energy conformers of the dyes and to calculate electrostatic potentials for these conformers. The RESP charge fitting procedure was used to derive atomic charges. All other parameters were assigned by analogy to pre-existing force field parameters. Several DNA- and RNA-fluorescent probe systems will be explicitly solvated in water and equilibrated before beginning production MD simulations. These simulations will be used to generate simulated fluorescence data for direct comparison to experimental bulk and single-molecule FRET data.

This research was supported by the National Science Foundation RUI, MRI, REU, & CIEG programs, the Howard Hughes Medical Institute, the ACS-Petroleum Research Fund, the Midwest Undergraduate Computation Chemistry Consortium, and Teragrid Cyberinfastructure.

Characterization of Tris(5-amino-1,10-phenanthroline) Iron II/III

Rebecca Danforth Mentor: Dr. Kenneth Brown Department of Chemistry

Tris(5-amino-1,10-phenantroline)iron(III/II) was characterized using spectroelectrochemical methods. This is due to the oxidation state change that the electropolymerized film exhibits when supplied with a potential, which causes the polymer film to oscillate between red and yellow. Initial studies took place on ceramic based Pine Pt. electrodes, which led to the discovery of the changing color. For spectroelectrochemical studies, ITO electrodes were used due to their transparency. The first combination of experiments was combining a UV-Vis spectra with Chronoamperometry. One is able to track the color change and absorbance as a function of a series of potentials. The second experiment combined UV-Vis Kinetics and cyclic voltammetry. Single wavelength of light can be tracked and the affects an oscillating potential can be seen in the absorbance. Using this experimental setup the effects of different salt sizes on the absorbance of the polymer film can be looked into. It appears that the absorption may be dependent on the size of the salt and possibly its concentration in solution.

Free-Jet Vibration-Rotation Spectroscopy of Unstable Species

Howard A. Dobbs Mentor: Dr. William F. Polik Department of Chemistry

Vibration-rotation spectroscopy is used to characterize molecular potential energy surfaces and thereby describe chemical interactions. Unstable species are highly reactive and electronically complex, making them valuable spectroscopic targets. However, such species must be created during the measurement process. This experiment uses an electric discharge nozzle to fragment a precursor molecule which is then analyzed using laser spectroscopy. Conversion between TTL and CMOS logic levels is necessary to ensure synchronization between production and observation of unstable species. Both fluorescence excitation and dispersed fluorescence spectra of dichlorocarbene (:CCl₂) were recorded. Vibrational levels of the ground electronic state have been assigned from these spectra.

CHEMISTRY



Novel Pyrrole-derivatized Diamino Polyamides and Their Impact on DNA Sequence Recognition

Matt Gregory

Mentors: Dr. Kimberly Brien, Dr. Vijay Satam, Dr. Moses Lee Department of Chemistry

Polyamides that contain imidazole and pyrrole heterocycles are known to target the minor groove of DNA in sequence specific interactions. Such molecules have the ability to alter gene expression. Analogs of the naturally occurring product distamycin have been developed and shown to bind in stacked anti-parallel dimers with their target DNA sequences. Various triamides containing imidazole and pyrrole moieties have been synthesized, and it was found that f-ImPyIm has better affinity and specificity in targeting its cognate DNA sequence, 5'-ACGCGT-3' than the binding of distamycin to its cognate sequence 5'-AAATTT-3'. With the addition of a second amine group, derivatives of f-ImPyIm have been synthesized in an attempt to increase solubility in aqueous media. In order to track polyamides in cells by means of fluorescence, novel Hx-moieties that are analogs of Hoechst 33258 were introduce in polyamide backbone. These molecules showed excellent binding affinity (K) and sequence specificity to their respective cognate DNA sequences, 5'-ACGCGT-3' and 5'-ATCGAT-3' while exhibiting strong fluorescence that allows tracking of these molecules in cells. The focus of this research is directed towards the development of diamino Hx-containing polyamides and testing the effects of the additional NH₂ linker on DNA binding properties in comparison to their monoamino counterparts.

Reinventing Wonder: An Interdisciplinary Study on the Beauty in the Small and Ordinary

Annalise Klein

Mentor: Dr. Mary Elizabeth Anderson Department of Chemistry

In an age when scientific discovery has exploded exponentially, society has become numb as discovery after discovery is churned out of academia and the research world, threatening to lose the awe-factor for the accomplishments brought through the great minds and technologically advanced equipment of today. The question begs to be asked, "What is our calling in being involved in science and discovery in the 21st century? Is the sole, functional purpose to aid in the ways our lives can be enhanced to become stronger, healthier, and more affluent?" While indeed an respectable role, this project aims to rejuvenate the wonder and fascination in the beauty of scientific discovery. Engaging interdisciplinary studies that bridge the sciences and humanities, this project excavates the way poets and philosophers contemplate the world, specifically the beauty that is overlooked in the ordinary and small. Inspired by images of chemical compounds and everyday objects taken at a nanoscale resolution using the Scanning Electron Microscope (SEM), a narrative will take shape through a collage of chemical research, philosophical musings, and poetry, challenging others to rethink what is often classified as "mundane" and "ordinary". This project is a collaboration on the way poets see the world, the beauty that is often overlooked in the ordinary and small, and the power of an image.

Using SEM and Color Analysis in Sediment Fingerprinting

Lauren Zandstra, Amanda Gernentz and Alexa Bakker Mentor: Dr. Graham Peaslee

Department of Chemistry

Lake Macatawa is a hypereutropic lake because of the excess sedimentation and attached phosphorus. To help battle the high phosphorous content in the lake, a variety of analytical methods are being employed through the Macatawa Watershed Project. The goal of this project is to use a Scanning Electron Microscope (SEM) and color analysis to study the size and shape of the sediment, biologicals such as pollen within the sediment and even reflected light color of the sediment to determine subtle differences that will allow a fingerprinting of sediment within the watershed. Images for analysis of size/shape and biologicals are collected using a SEM and analyzed using commercial software. Due to the variation in pH, vegetation, and soil type each part of the watershed has distinctive characteristics. Data collected from the SEM will be combined with RGB color analysis of the sediments as well. This fingerprinting of the sediment will allow for preliminary attribution of the nonpoint source pollution to individual sub-watersheds and allow for the prioritization of remediation methods to improve the overall water quality of Lake Macatawa.

CHEMISTRY

Investigation of Regioselectivity in the Nickel-Mediated Decarbonylative Cross-Coupling of Imides with Organozinc Reagents

Thomas B. D. Endean Mentor: Dr. Jeffrey B. Johnson Department of Chemistry

Recent studies have demonstrated a nickel/bipy-mediated decarbonylative cross-coupling of cyclic imides with diorganozinc reagents. This reaction has been demonstrated with a wide range of *N*-substituted phthalimides and with a variety of organozinc nucleophiles. In order to gain additional mechanistic insight into this transformation, a series of 3- and 4-substituted imides were prepared and subjected to decarbonylative alkylation. The reactions were analyzed through GC and NMR spectroscopy to determine the regioselectivity of the resulting products. This presentation will detail these efforts and outline efforts to control regioselectivity within this reaction manifold.

This material is based upon work supported by the Henry and Camille Dreyfus Foundation.

Analysis of Phosphates in Macatawa Watershed Sediment

Adam M. Maley Mentor: Dr. Graham F. Peaslee Department of Chemistry

Analysis of phosphates, a non-point source pollutant, in sediment is important for understanding the eutrophic nature of the Macatawa Watershed. These phosphates, which enter Lake Macatawa, are transported throughout the watershed by adhering to clay particles suspended in water, typically after heavy precipitation. Phosphorous is the limiting reagent in eutrophication, therefore, high amounts result in potentially harmful algae blooms that decrease the overall quality of the water. Accurate analysis of phosphate levels help pinpoint the most important areas to manage sediment erosion and phosphate runoff in the watershed. After heavy precipitation, sediment samples are collected and water-soluble, iron-bound, and calcium-bound phosphates are extracted for continuous flow analysis by the AutoAnalyzer IIITM. Results are recorded in concentrations of phosphates where the sum of the three extractions gives the total amount of bioavailable inorganic phosphates. Preliminary results have shown the areas of most concern are the Noordeloos Creek subwatershed and the North and South branches of the Macatawa River. Comparison of iron-bound and calcium-bound phosphate level ratios shows a strong correlation between rain events for each sample site. Additionally, comparison with Particle Induced X-Ray Emission (PIXE) data shows a strong correlation between Fe:Ca elemental ratios and the iron-bound and calcium-bound phosphate levels.

This material is based upon work supported by The National Science Foundation, The Macatawa Area Coordinating Council, The Outdoor Discovery Center, and the Michigan Department of Environmental Quality.

Thiophene-Substituted Porphyrins as Redox Mediators for Electrochemical Biosensors

Brian P. Mulhern and Jesse R. Alvarado

Mentors: Drs. Elizabeth M. Sanford and Kenneth L. Brown Department of Chemistry

Electrochemical biosensors are instruments that use molecular recognition components such as enzymes to selectively detect biomolecules through a mechanism involving the transduction of a signal from an electron transfer reaction. In such a system it is necessary for multiple layers of a device to communicate the electron transfer reaction from the layer in which it occurs to the electrode. For this communication to occur well, a redox mediator is typically needed between the enzyme layer and the electrode. This work describes the preparation of thiophene substituted porphyrins that are then polymerized on electrodes to provide a communication or redox mediation layer between an enzyme and electrode.

Next Generation Perimidinespirohexadienone Derivatives

Benjamin J. Pollock

Mentor: Dr. Jason G. Gillmore Department of Chemistry

Creating electron deficient perimidinespirohexadienone (PSHD) photochromes to "gate" sensitivity toward photoinduced charge transfer (PICT) reactions is the primary focus of the Gillmore group. Previous modification has included the replacement of the of the naphthalene moiety in the PSHDs with a quinoline, resulting in quinazolinespirohexadienones (QSHDs). In the present work, oxazinoquinolinespirohexadienones (OSHDs), QSHD analogs in which a bridging nitrogen atom is replaced with an oxygen, have been prepared and studied. Our computational methods would have predicted these to be more potent photooxidants. Unfortunately NMR, UV-vis, and X-ray analyses indicate these analogs are not photochromes but rather exist exclusively in the open, long wavelength (LW) form. Two tautomeric structures of this LW isomer are possible. Contradictory NMR and cyclic voltammetry evidence for the structure in solution will be presented and compared with X-ray diffraction data on the crystalline solid state structure. We have also begun to analyze the structures of compounds with similar tautomeric possibilities, prepared as synthetic intermediates en route to this product in an attempt to understand the observed lack of photochromism. In a second new direction, we have begun to attempt to prepare analogs of our QSHDs (and potentially OSHDs) in which the quinoline nitrogen is alkylated to form quinolinium salts. These are predicted to be potent photooxidants. But in addition to studying these alkylated photochromes for gating sensitivity to PICT, we are interested in studying these molecules' ability to perhaps gate DNA intercalation. This may occur as quinoliniums are potent intercalators, and there is a decrease in steric bulk near the quinolinium when the central perpendicular spirocyclic dienone moiety in the SW isomerizes to a more planar and offset quinonimine moiety in the LW upon photochromic rearrangement.

This research was supported by National Science Foundation CAREER award CHE-0952768.

Mechanistic Investigations of Alkene Carboacylation via C-C Bond Activation in Quinolinyl Ketones

Colin M. Rathbun and J. Patrick Lutz

Mentor: Dr. Jeffrey B. Johnson Department of Chemistry

Carbon-carbon single bonds form the framework for many organic molecules, but in most cases, they cannot be functionalized. This presentation will summarize the mechanistic investigation of the rhodium-catalyzed intramolecular carboacylation of an alkene, proposed to proceed through carbon-carbon bond activation. A kinetic analysis revealed an unusual first order rate law with no rate dependence upon substrate. Additional experiments identified the catalytic resting state, while determining activation parameters and $^{12}C/^{13}C$ kinetic isotope effects. Additional studies indicated that electron-donating groups increased the rate of reaction. This conclusion is consistent with the kinetics of the parent compound, as electron-donating substituents would be expected to stabilize the high-energy, electron-deficient intermediate of the rate-limiting C-C insertion step. A related mechanistic investigation with a second rhodium catalyst has revealed a similar but distinct mechanism. The combined insight from these studies promises to guide the development of new carbon-carbon single bond activation methodologies.

This material is based upon work supported by the Research Corporation under award number 7833 and the Camille and Henry Dreyfus Foundation.

Preparing for Harvesting Radioisotopes from FRIB

Nicholas R. Wozniak

Mentors: Drs. Aranh Pen and Graham Peaslee Department of Chemistry

The Facility for Rare Isotope Beams (FRIB) will be a new national user facility, funded by the Department of Energy Office of Science (DOE-SC) Office of Nuclear Physics and operated by Michigan State University (MSU). The new facility will have the capability to accelerate uranium to 200 MeV/nucleon and lighter ions with even more energy. FRIB will generate a host of new isotopes that could be harvested for off-line use. A feasibility study to harvest useful long-lived radioisotopes from FRIB is being conducted. The study will use current conditions at the National Superconducting Cyclotron Lab (NSCL) to quantify and characterize the production and extraction yields of six important radioisotopes. The relatively long-lived isotopes are ²²Na, ⁶⁷Cu, ⁴⁸V, ⁸⁵Kr, ⁴⁴Ti, and ³²Si. The radioisotopes of interest will be collected in an aqueous beam stop at FRIB. Modeling of the nuclear reactions present at the NSCL was done using the LISE++ program. The information from the modeled reactions is being used to streamline the procedures for isolating and extracting the radioisotopes of interest from the aqueous beam dump at FRIB. The isolation and extraction procedure is first being developed using commercial chelating disks for "cold," non-radioactive, species. The procedure will then be applied to "hot," radioactive, species before being implemented at the NSCL and, eventually, FRIB.

This material is based upon work supported by the James N. Boelkins Natural and Applied Sciences Division Research Award and the Hope College Department of Chemistry.

Thermoelectric Material Synthesis and Characterization

Jonathan Yarranton

Mentor: Dr. Mary E. Anderson Department of Chemistry

Since the discovery of thermoelectric (TE) materials, they have been of much interest to the scientific community because they are able to convert thermal energy to electrical energy and, inversely, utilize electrical energy to create temperature gradients. This allows for TEs to recycle heat energy lost from processes, reducing energy consumption and increasing efficiency. These materials have many advantages over traditional heating and cooling appliances and power generators, for example noiseless operation, no moving parts, and no fluids such as freon. Despite these properties, TEs currently lack high power conversion. To improve these, n- and p-type dopants are added to create distortions in the crystal structure to increase phonon scattering. Increased scattering is also found in nanoscale TEs. TEs are usually synthesized using solid-state high energy routes such as ball milling which tend to have low yields. We utilize an alternative solution phase approach, modified polyol synthesis, to make TE nanoparticles. Appropriate metal salts are dissolved in tetraethylene glycol, reduced in solution by sodium borohydride, and heated. These nanoparticles are characterized primarily by X-ray diffraction spectroscopy and scanning electron microscopy. The focus of this research has been the optimization of this synthetic method and the fabrication of novel materials.

Biochemical and Biological Properties of Fluorescent Polyamides

Mia Savagian, Amanda Ferguson

Mentors: Drs. Balaji Babu, Kimberly Brien, Vijay Satam, Shicai Lin, Konstantinos Kiakos, John A. Harley, Moses Lee Department of Chemistry and Cancer Research UK Drug-DNA Interactions Research Group, UCL Cancer Institute, London UK

Polyamides containing imidazole and pyrrole units target the minor groove of DNA by making specific sequence specific interactions and hydrogen bonds with the four base pairs of DNA in stacked, anti-parallel dimers. Other groups, such as phenyl and formyl, have been added to these polyamides with the goal of increasing sequence specificity, binding affinity, solubility, as well as to enhance the convenience in synthesis. However, in order to track the movement and localization of these compounds in cells, the need for polyamides that both fluoresce and bind to DNA in a sequence selective manner was realized. Ligands (Hx) of Hoechst 33258 (bisbenzimidazole), a small fluorescent molecule that acts like two consecutive pyrroles in targeting A/T rich sequences of DNA, were incorporated into polyamides. One such polyamide, Hx-IP was found to bind a sequence 5'-TACGAT-'3 present in the 5-flank of the ICB2 element in the promoter of topoisomerase II, thus blocking the repressor transcriptional factor NF-Y. A variety of DNA binding studies have been conducted on Hx-IP. Results from these studies will be presented.

Development of a Nickel-Catalyzed Decarbonylative Cross-Coupling Reaction of Cyclic Imides

Jessica M. Simmons Mentor: Dr. Jeffrey B. Johnson Department of Chemistry

A decarbonylative cross-coupling of *N*-substituted cyclic imides occurs in a reaction with diorganozinc reagents in the presence of stoichiometric Ni(COD)₂ or Ni(acac)₂ and a bipyridine ligand, producing *o*-substituted benzanilides (*J. Org. Chem.*, 2011, 76, 3588). Diorganozinc reagents used include diethyl zinc and a wide variety of *in situ* synthesized diarylzinc compounds including o-, *m*-, and *p*- substituted aryl rings, di- and tri- substituted aryl rings, and substitutions containing electron withdrawing and electron donating groups. Conditions for the development of the more desirable catalytic reaction have been explored by varying the solvent and ligands in order to favor the disassociation of CO from nickel and result in catalytic turnover. The highest turnover observed with the decarbonylative product occurred with 4,4'-dimethoxy-2,2'-bipyridine in DMF. Further studies will be done to develop the catalytic function of this decarbonylative reaction.

This research was supported by the Camille and Henry Dreyfus Foundation and the Towsley Foundation.

A New Imidazole-derivatized Diamino Polyamide Design: Synthesis and DNA Binding

Thomas Smeltzer and Alex Porte

Mentors: Drs. Kimberly Brien, Balaji Babu, Vijay Satam and Moses Lee Department of Chemistry

Polyamides that are analogs of the natural product distamycin have proven to be effective agents to selectively bind in the minor groove of DNA. Of particular interest is the triamide containing imidazole and pyrrole heterocycles, f-ImPyIm, which showed better affinity and specificity in targeting its cognate DNA sequence, 5'-ACGCGT-3' than distamycin's preference for 5'-AAATTT-3'. Several analogues have been synthesized with different modifications, which alter properties such as solubility, fluorescence, binding affinity, and sequence specificity. It has been found that by placing a second amino group in a pyrrole unit of the polyamide core it is possible to improve binding affinity without compromising sequence selectivity. Such an amino group helps to increase solubility of polyamides in aqueous media. In this project a novel polyamide containing a comparably functionalized imidazole ring was synthesized to study it's DNA recognition properties.

Modifying Gene Expression to Expose Plasmodium falciparum to Immune System Attack

Robert Sjoholm

Mentors: Drs. Stephanie Yanow and Dr. Moses Lee Provincial Laboratory for Public Health, Edmonton and Department of Chemistry

Downregulation of malarial *rif* gene expression, a process implicated in malarial evasion of the human immune system, has been linked with repressor protein binding to the DNA element ATGCAA in *Plasmodium falciparum*. A Pyrrole- and Imidazole-containing polyamide was designed with the purpose of recognizing that DNA sequence based on previously reported pairing rules. The polyamide was also designed to target *P. falciparum* over mammalian cells by exploitation of the protozoal P2 aminopurine transporter. It is hypothesized that the target molecule, by blocking repressor protein binding, will effectively enhance *rif* gene expression in *P. falciparum*, allowing immune destruction of the protozoan. The following will be described: the synthesis of the target compound, a thorough analysis of the compound's binding affinity and selectivity for the DNA sequence ATGCAA (using thermal melts, CD, ITC, and DNA footprinting), the *in vitro* cytotoxicity against mammalian cells and *P. falciparum*, and an investigation into the ability of the compound to alter *rif* gene expression in the parasite (using real-time PCR).

CHEMISTRY



Design, Synthesis and Cytotoxicity of Novel 3-Arylidenones Derived from Alicyclic Ketones

Samuel Tzou

Mentors: Drs. Kimberly Brien, Vijay Satam, Ravi Kumar Bandi, Ajaya Kumar Behera, Bijay Kumar Mishra, Balaji Babu, Matthias Zeller, Moses Lee and Hari Pati

Department of Chemistry and Sambalpur University, Jyoti Vihar, Sambalpur, Orissa, India and Youngstown State University

As part of the studies in our laboratories aimed at improving the cytotoxicity of combretastatins and chalcones, forty-four novel chalcone analogs derived from alicyclic ketones were designed, synthesized and investigated for cytotoxicity against murine B16 and L1210 cancer cell lines. The chalcone analogs belong to four structurally divergent series, three of which (series **g**, **h** and **i**) contain differently substituted cyclopentanone units and the fourth (series **j**) contains a 3,3-dimethyl-4-piperidinone moiety. Of these, the chalcone analogs in series **j** showed potential cytotoxic activity against murine B16 (melanoma) and L1210 (lymphoma) cells. The most active compounds **5j**, **11j**, **15j**, and **12h** produced IC_{50} values from 4.4 to 15 mM against both cell lines. A single crystal X-ray structure analysis and molecular modeling studies confirmed that these chalcones have an *E*-geometry about the alkene bond and possess a slightly "twisted" conformation similar to that of combretastatin A-4. Compounds **5j**, **11j**, and **15j** did not inhibit tubulin polymerization in A-10 cells suggesting they may have a different mechanism of action.

CytoSEED: Software for Viewing and Analyzing Bacterial Metabolic Models

Nicholas Hazekamp and Joshua Kammeraad Mentor: Dr. Matt DeJongh Department of Computer Science

The goal of our research is to develop software that will help biologists to better understand and visualize the metabolic pathways of bacteria. A metabolic pathway is a group of compounds and reactions involved in a specific biological process. The Model SEED project currently provides a static viewer for bacterial metabolic pathways. However, this viewer does not support editing pathways - in particular adding, removing, and moving nodes that represent reactions and compounds to different pathways. The software we have developed addresses this shortcoming by replicating the capabilities of the current viewer and allowing modifications to the metabolic pathways. These modifications include the ability to move reactions and compounds between existing and newly created pathways. We have also implemented the ability to view multiple bacterial models simultaneously so biologists can easily compare pathways to comprehend differences between bacteria. A goal of this project has also been to take the information that is available within the Model SEED and display it in a more accessible way. This is done through node coloration and connections as well as displaying information inside panels. Our software enables biologists can use information provided by our software to design laboratory experiments that test bacterial metabolism under specific conditions and view the results. These capabilities enable biologists to gain more knowledge about bacteria relevant to human health, energy production, and environmental impact.

This research was supported by the NSF grants 0745100 and 0850546.

The JanDY Online Survey System

Matthew Johnson, Joshua Kamstra, and Michael Henley Mentor: Dr. Ryan McFall Department of Computer Science

The JanDY Survey System is a continuation of an ongoing project started by Dr. McFall. This project aims at enhancing the capabilities of the existing online survey system used at Hope College. Over the course of the summer the existing creation wizard was edited and improved, allowing the survey creator a wide range of possibilities. These include strict survey start and end dates, the option for different types of user authentication, and the option for survey anonymity. The actual ability to display and take a survey was implemented where users can expect to see anything from multiple choice to short answer response questions. The ability to save a survey's data was also added so that incomplete surveys can be resumed at a later date or multiple responses can be supplied by the same person. A reporting system was also created that allows for professional looking reports to be auto-generated for the viewing of any survey's results. Work on this project continued into the school year where new features started to be added to system while parts already implemented were improved.

This research was supported by the National Science Foundation under NSF grant No.0851293

COMPUTER SCIENCE

The Complexity of Pebbling in Diameter Two Graphs

Timothy Lewis and Daniel Simpson Mentor: Dr. Charles Cusack Department of Computer Science

Given a simple, connected graph, a pebbling configuration is a function from its vertex set to the nonnegative integers. A pebbling move between adjacent vertices removes two pebbles from one vertex and adds one pebble to the other. A vertex r is said to be reachable under a configuration if there exists a sequence of pebbling moves that places one pebble on r. A configuration is solvable if every vertex is reachable. We prove tight bounds on the number of vertices with two and three pebbles that can exist in an unsolvable configuration on a diameter two graph in terms of the size of the graph. We also prove that determining reachability of a vertex is NP-complete, even in graphs of diameter two.

This work was supported by the National Science Foundation Research Experience for Undergraduates Program grant No. 0851293.

Graph Games: Human Computing Games to Solve Graph Problems

Hsiang Lin and Russell Zinn Mentor: Dr. Charles Cusack

Department of Computer Science Graph Games is a collection of games with the purpose of gathering data from player solutions for solving graph-related problems that are difficult for computers to solve efficiently. The data will be used to solve instances of and improve algorithms for various problems on graphs. We made several important improvements to the Graph Games software. Now every move made by the player, including the timing between moves, is stored. The replay system was also improved so that player solutions can be replayed move by move, in real time, or sped up or slowed down. So that players can more easily understand the game mechanics, we also created playable tutorials and an extensive editor for the tutorials. These enhancements will allow us to conduct player studies to investigate how well humans who have no specific knowledge or

training in graph theory can do at solving graph-related problems by playing our games.

This work was supported by the National Science Foundation Research Experience for Undergraduates Program grant No. 0851293.

ENGINEERING

Nondestructive Evaluation of FRP Bridge Deck Panels

Philip Hallam

Mentor: Dr. Jeffrey Brown Department of Engineering

The purpose of this research was to investigate Infrared Thermography (IRT) as a Non-Destructive Evaluation (NDE) method for glass fiber-reinforced polymer (FRP) composite bridge deck panels. FRP bridge decks are currently being evaluated as a potential replacement for traditional steel-grate or concrete bridge decking. A potential problem with these decks, however, is that structural damage that can occur due to overloading or environmental factors may not be visible from the top or bottom surface of the deck. Two decks were tested in the current study: one that had been loaded to failure and another that was undamaged. External heat was applied through the use of 8 halogen lamps arrayed around the outside, while an FLIR A320 ThermoVision infrared camera was set up to view the samples. The proximity of the lamps to the deck, the proximity of the camera to the deck, and the angle of the lights were all varied over the course of the testing, as well as different surface preparations from sanding to painting. Results indicate that IRT is potentially useful for evaluating the integrity of FRP bridge decks, but additional research is needed to better understand the influence of non-uniform heating.

This work is supported by the Florida Department of Transportation.

Implementation and Control of a Reconfigurable 8-Tetrahedral Robot

Cornelius Smits Mentor: Dr. Miguel Abrahantes Department of Engineering

An engineering team at the NASA Goddard Space Flight Center in Maryland initiated the development of tetrahedral structures, in order to further advance the capabilities of space exploration vehicles. These structures are made up of tetrahedral cells with extendable and contractible struts. Tetrahedral robots can navigate complex terrain too rough for current exploration vehicles, allowing exploration in regions never traversed. This past summer, our objective was to improve the hardware and software used on the 8-Tetrahedral structure prototyped the previous summer. This included improvements of the communication between multiple digital devices necessary for autonomous control and improvements in the mechanical design of the robot. This 8-Tetrahedral Robot prototype completed a tumbling gait resembling amoebic movement. This physical implementation is fundamental to the advancement of tetrahedral robotics research.

This material is based upon a grant from MSGC and the Hope College Engineering Department.

Vapor Pressure Predictions of the Sanchez-Lacombe Equation

Nicholas T. Hubley Mentor: Dr. Michael J. Misovich Department of Engineering

This research involved the study of the Sanchez-Lacombe (S-L) Ising (lattice) fluid equation of state (EOS). Chemical engineers use EOS to estimate vapor-liquid equilibrium properties such as vapor pressure for process analysis and simulation. A Maple $13^{\text{(B)}}$ computer program generated vapor pressures from the S-L equation as a function of temperature for ranges of equation parameters. Characteristic temperature T^{*}, characteristic pressure P^{*}, and size parameter r were varied. These characteristic parameters differ numerically from the critical parameters used in most EOS; however, changing the characteristic parameters had no effect on the dimensionless relationship between vapor pressure and temperature expressed as reduced variables by dividing by critical constants. The size parameter r did affect the dimensionless relationship of vapor pressure to temperature. This was quantified by a quadratic relationship between r and the acentric factor ω used in standard corresponding states models and some common equations of state. Work continues to compare S-L vapor pressures to those predicted by cubic equations of state like Soave-Redlich-Kwong and Peng-Robinson and to produce a generalized Antoine vapor pressure relationship for S-L.

This material is based upon work supported by the Dean of Natural Science Research Award.

Failure Predictions of a Clamped Plate Under Close-in Blast Loading

Brigid Toner Mentor: Dr. Roger Veldman

Department of Engineering

The goal of this project was to create an effective computer simulation that predicts the response of a thin clamped plate to close range explosive blast loading. In this study, the response of two models created with the commercial software program LS-Dyna were compared to actual results from physical testing. The first model used a Lagrangian model for the structure and the LOAD_BLAST function within LS-DYNA. This method applies blast pressures to a structure according to a database of measured explosive pressures based on charge size and distance from the detonation. In the second model, the explosive event was simulated using an Arbitrary Langrangian Eulerian (ALE) model, which includes a model of the high explosive and the ambient air in addition to the thin plate. It was found that the LOAD_BLAST model applied higher pressures on the plate since this method applies pressure loads as if the structure were stationary. In the ALE model, the fluid-structure interaction of the air, explosive, and plate were calculated as the plate deflects under the applied blast loading. Due to the plate movement during the blast pulse, a decreased amount of pressure was applied to the panel when compared to a stationary structure. Since this deflection of the thin plate during the applied blast pulse more closely models the actual behavior of the structure, the ALE modeled predictions were found to be more consistent with the experimental data for overall plate deflections.

This material based on a grant from the U.S. Department of Homeland Security

Case Study of Small-Scale Wind Turbine Power Production

Laine Klopfenstein

Mentor: Dr. Ruth Douglas Miller Department of Electrical and Computer Engineering, Kansas State University

The purpose of this study was to determine the efficiency of a small-scale wind turbine. The turbine, an AIR Breeze©, was installed on the Kansas State University engineering building roof. Its power production was recorded using an Enphase Energy© M190 microinverter which tied the turbine to the grid. Using data from a nearby meteorological tower (MET tower), and adjusting for elevation change, the turbine's power curve and coefficient of power were determined. This data was then compared to another turbine, a SkystreamTM, in the area and the published power curves for the turbines. It was found that the turbine has a very low coefficient of power, most likely due to its location and surrounding structures. The coefficient of power found was around 0.1 while that of the nearby turbine was 0.15. It can be concluded that the location of the turbine is not ideal, and the turbulence caused by the surrounding structures has a larger effect on the turbine power production than the altitude adjustment between the MET tower site and the turbine.

This research was supported by Earth, Wind, and Fire: Sustainable Energy in the 21st Century REU program at Kansas State University, funded by NSF Award #0851799.

Adaptations of Concept Mapping for Technical System Design

Lauren Aprill Mentor: Dr. John Krupczak Department of Engineering

Development of new products is a challenging task which generally must contend with rapidly changing technological stateof-the-art, imprecise knowledge of consumer preferences, and multidisciplinary teams often situated in different geographical locations. Equally challenging is finding effective methods to communicate central features of technological systems to a diverse audience of participants with limited background knowledge. Methods of assessing team comprehension are needed that extend beyond superficial questions that but do not require extensive prerequisite engineering knowledge. Communication or explanation of how technical systems work requires a method that can represent a diverse range of technological products but that non-engineers can learn in a limited amount of time. The technique of concept mapping has been adapted to this purpose. Concept mapping provides a visual method of demonstrating the relationships that exist between the component parts of a larger body of information. Such a feature is well-suited for explaining technical systems. In one application concept mapping is combined with aspects of the engineering design technique of functional analysis or functional decomposition to create a method that can be used to describe or explain the central elements of system design across a broad spectrum of technological domains.

This work is supported by the National Science Foundation under award: DUE-0633277 and DUE-0920164.

Surface Stimulation to Alleviate Phantom Limb Pain

Derek Blok and Johanna Forst Mentor: Dr. Katharine Polasek Department of Engineering

Phantom Limb Pain (PLP) is a post-amputation phenomenon causing painful sensation seeming to originate in the missing limb. These sensations range from mild to severe and with intermittent occurrences in 50-80% of amputees. The exact etiology of PLP is not known,, but one leading hypothesis involves the reorganization of the neural connections in the cerebral cortex causing the phantom sensations to arise from real sensations being experienced elsewhere. The working hypothesis is that if some form of "real" sensation can be created in the phantom limb, the cortical reorganization process can be slowed or reversed and the phantom limb pain can be significantly reduced. This will be done through electrical surface stimulation of the severed nerves in the residual limb at the elbow, with the goal of producing sensations that seem to be arising from the phantom limb. Before this process can be attempted in amputee patients, however, significant testing must be done in healthy subjects to determine the effectiveness of surface stimulation to produce real sensations. In order to do this study, testing parameters and stimulation capability requirements were determined and MATLAB software capable of providing a wide range of stimuli was developed. The experimenter can provide electrical stimulation to multiple electrodes in the form of either symmetric or non-symmetric square waves, with full control of the pulse width, amplitude, frequency and duration of the stimulation. A new research application was also completed and reviewed by the Hope College Human Subjects Review Board. Approval of the research application will allow for research with able-bodied subjects with future work to build off of these results for amputees.

This project was funded by the Dean of Natural and Applied Sciences Faculty Research Fund.

Factors Affecting Kinetics and Equilibrium of Biodiesel Transesterification

Katherine A. Brune

Mentor: Dr. Michael J. Misovich Department of Engineering

Biodiesel fuel is produced by the transesterification of triglycerides from renewable resources such as animal and plant oils. Aspects of the kinetics and equilibrium of the transesterification reaction using waste vegetable oil (WVO) were studied. Variables included properties of the WVO, such as water content and free fatty acid content, along with other process parameters and inputs. Reactions were performed in 50 g batches and 0.10 g samples were taken at intervals and quenched by catalyst neutralization and cooling. Conversion was analyzed using ¹H NMR, while water contents of reactants and products were measured using coulometric Karl Fischer titrations. Water content of the alcohol/methoxide reactant was observed to have little effect on the reaction rate or equilibrium. An unexpected exotherm was observed during reaction following isopropyl alcohol extraction of free fatty acids from the WVO. Biodiesel made using a recycled glycerol/methanol/methoxide reactant appeared similar to product made from fresh methanol/methoxide reactant, but analysis of the kinetics and equilibrium composition was inconclusive in verifying the suitability of recycling waste into subsequent reaction batches. Further studies of reactions following isopropyl alcohol wash of WVO and using recycled waste are recommended.

This material is based upon work supported by a grant from the Howard Hughes Medical Institute and the Hope College Engineering Department

Numerical Simulation of Fluid-Structure Interaction Using an Impulse Plug

Christian Calyore

Mentor: Dr. Roger Veldman Engineering Department

The goal of this project was to develop a method for simulating the effects of fluid-structure interaction upon plates of varying thickness resulting from a high explosive blast. This effect was simulated by modeling an impulse plug model using the commercial explicit finite element software AUTODYN. Four different plug thicknesses were used ranging from 0.040 inches to 2.0 inches. All of the components in this system were modeled in AUTODYN including the impulse plug, a non-responsive shield, the surrounding air and the high explosive. The plug and shield were modeled using Lagrangian elements while the air and explosive were modeled using Eulerian elements. The 3D representation of the model was created by revolving a 2D axial symmetry around the desired axis. From the results of the simulation, the predicted plug velocity was used to calculate blast impulse that impinged on the plug face. The results of these predictions showed no significant differences in the impulse delivered to the plugs of varying mass.

This material is based on a grant from the U.S. Department of Homeland Security.

Exploring the Relationship between Multi-Segment Foot Kinematics and Plantar Pressure Data in Adolescents with Planus and Cavus Foot Deformities: A Pilot Study

Elena Caruthers

Mentor: Drs. Katharine Polasek and Krisanne Chapin Department of Engineering and Mary Free Bed Hospital

The medial longitudinal arch (MLA) plays a significant role in shock absorption and elasticity with respect to the motion of the foot. Pes planus (low MLA) and pes cavus (high MLA) are two deformities of the MLA commonly present in children with neurologic disabilities, which can contribute to abnormal walking patterns and the development of chronic foot pain long-term. It is often assumed that a change in MLA height equates with a change in medial or lateral plantar pressure. However, this relationship has not been sufficiently studied. The aim of this study was to investigate the relationship between MLA height and plantar pressure for specific regions of the foot to test the validity of this assumption. This study was accomplished by conducting a retrospective study using data gathered from the computerized gait analysis laboratory of a local rehabilitation hospital. By using a technique developed to integrate a multi-segment foot (MSF) model and plantar pressure data, the relationship between the severity of foot deformity and plantar pressure was examined; Spearman and Pearson coefficient values were calculated to determine the relationship between selected plantar pressure variables with respect to the mean stance MLA angle (MLAA); the relationship was considered statistically significant if the coefficient value was greater than .50 with a p-value of less than .05. More pes planus feet were found to have significantly higher impulse and contact area values in the plantar pressure of the medial midfoot region and more cavus feet were found to have higher mean pressure and impulse values in the plantar pressure of the lateral forefoot region. By measuring the MLAA from MSF kinematics interfaced with plantar pressure data, the magnitude of planus and cavus appears able to be assessed objectively, providing a useful way for tracking the progression of these common foot deformities over time.

This material based on a grant from the Howard Hughes Medical Institute.

GEOLOGY & ENVIRONMENTAL SCIENCE

Tetracycline and Metal Oxide Nanoparticles in Aqueous Solutions: Implications for Pharmaceutical Transport in Natural Waters

Nicholas Powers

Mentors: Drs. Jonathan Peterson and Michael Seymour

Departments of Geological and Environmental Sciences and Chemistry

Widespread use of pharmaceuticals and their subsequent detection in natural waters is a growing concern. The fate and transport of drug contaminants likely involves nanometer-size (10^{-9} m) oxides. This study investigated the interaction of tetracycline (TC), a common polyprotic antibiotic, with several metal oxide nanoparticles (NPs). Batch experiments were performed using 25-50 mg of four NPs (Al₂O₃, Fe₂O₃, SiO₂, and TiO₂) and varying concentrations of TC solutions ($0.44 - 444 \mu$ M) over a range of pHs (2.3 - 8.7).

Data indicate that the amount of TC removed from solution (C* = μ mol TC removed/mass of NP) is due to adsorption and/or NP-facilitated transformation. Experiments indicate that electrostatic interactions are not predictable. The relationship between the pH-dependent surface charge (point of zero charge = pzc) of SiO₂ and speciation of TC yields low attraction at pH 5 (C* ~4,000 μ mol/kg) (all C* values reported are for initial TC concentrations of 111 μ M), where the drug is zwitterionic and the substrate surface is (-). At pH 8.7 TC is (1-) and SiO₂ is (-), and C* ~42,000 μ mol/kg. At pH 2.3, SiO₂ is (+) and TC is (1+), and the attraction is moderately low (C* ~7,000 μ mol/kg). In mixes with Fe₂O₃, TC was completely removed at pH 5 (substrate+/zwitterionic drug). Greater removal occurred at pH 2 (C* ~ 30,000 μ mol/kg) than at pH 8.7 (C* ~ 13,000 μ mol/kg). TiO₂ removed all TC from solutions through 111 μ M, at all pH conditions investigated. Solubility of TC limited higher concentration experiments to pH 2.3, where data were fit with Freundlich isotherms. Removal coefficients illustrate that TiO₂ removed the most TC (Kr=40738 L/kg), followed by Fe₂O₃ (Kr =8,709 L/kg) and SiO₂ (Kr =407 L/kg). Because Al₂O₃ increased solution pH, data were considered separately, and TC removal showed an approximate correlation with electrostatic trends.

Calc-Silicate Enclaves in High-Grade Gneisses from Halland, Southwest Sweden

Dean Hazle, Nathan Erber and Leah LaBarge

Mentors: Dr. Edward Hansen

Department of Geological and Environmental Sciences

The Stensjöstrand association crops out in a 5 kilometer strip along the coast north of Steninge, Halland Province, Southwest Sweden. It consists of amphibolites, sillimanite-bearing quartzofeldspathic gneisses and sillimanite-free quartzofeldspathic gneisses interbanded on scales ranging from 10's of centimeters to 100's of meters. On the north and south margins of the coastal strip, the Stensjöstrand association is bordered by granitic to granodioritic orthogneisses. Partial melting has led to the widespread development of metatexites with tonalitic leucosomes in the amphibolites and granitic leucosomes in the sillimanite-bearing and sillimanite-free quartzofeldspathic gneisses. Calc-silicate lenses ranging from 10's of centimeters to several meters in length occur sporadically in both the amphibolites and sillimanite-free quartzofeldspathic gneisses. These lenses tend to occur in linear arrays suggesting that they may have been continuous layers boudinaged and disrupted during deformation. The core of these lenses contains epidote with variable amounts of plagioclase and garnet. Electron microprobe analyses of samples from 3 lenses give epidote compositions with 9-13 mole % clinozoisite and piemontite concentrations < 2.5 mole %, an average plagioclase concentration of 87% anorthite and calcic garnet compositions that range from 31 to 41 mole % grossular, 33 to 60 mole% andradite, and lesser amounts of almandine (7 to 15 mole %,) and spessartine (1 - 13 mole %). In lenses within amphibolites, the epidote/garnet core is surrounded by a clinopyroxene-plagioclase zone. Microprobe transects across this zone towards the epidote/garnet core show a continuous increase from 50% to 85% in the anorthite content of plagioclase accompanied by an increase from 0.25 to 0.5 in the Fe/(Fe+Mg) ratio of clinopyroxene. The current mineralogy and mineral chemistry of the calc-silicate lenses appear to have developed by diffusion metasomatism during high-grade metamorphism between an iron-rich, calcareous, possibly sedimentary protolith and a mafic, possibly volcanic, rock.

This research was supported in part by the SGU (Sveriges geologiska undersökning: Geological Survey of Sweden), Sigma Xi and Hope College

GEOLOGY & ENVIRONMENTAL SCIENCE

Using Plant Macrofossils and Other Paleoenvironmental Indicators to Determine Paleoenvironmental Conditions in an Allegan County, Michigan Bog

Nathan Erber

Mentors: Prof. Suzanne DeVries-Zimmerman and Dr. Edward Hansen Department of Geological and Environmental Sciences

Detailed plant macrofossil analyses were performed on peat cores from an Allegan County, Michigan bog and used with the paleoenvironmental proxies organic bulk density (OBD) and siliceous microfossil abundances to determine the paleoenvironmental conditions of this bog. The plant macrofossils were divided into four different ecological communities. Community #1, the lowermost assemblage, has sedge species, low OBD values, and abundant sponge spicules and marks the beginning of the accumulation of large amounts of fibrous plant material into a shallow open lake wetland ~8000 cal YBP. Community #2 has deeper water sedge and Nymphaeaceae species, low OBD values, and abundant sponge spicules, suggesting an increase in water depth. Community #3 marks the appearance of ericaceous and *Sphagnum* species, the disappearance of sponge spicules, and a steady increase in OBD, suggesting the beginning of a near emergent bog surface ~3000 cal YBP. Community #4 begins with charcoal, fine ash and no recognizable vegetative matter, suggesting a fire. The vegetation transitions from ferns and sedges after the fire to ericaceous species and *Sphagnum*. Sponge spicules are absent and OBD values are high suggesting that the bog surface has become emergent. Over time, the bog has undergone hydroseral succession in conjunction with changes occurring in response to climatic changes.

This research was supported by the Michigan Space Grant Consortium, the Fulbright Commission, and Hope College.

Cathodoluminescence of Feldspar Minerals

Kristen Hasbrouck¹

Mentors: Sarah Brokus¹, Danielle Silletti², Dr. JoAnn Buscaglia³, and Dr. Graham Peaslee⁴ (1) Hope College Department of Geological and Environmental Sciences, (2) Hope College Department of Chemistry, (3) Counterterrorism and Forensic Science Research Unit, FBI Laboratory, (4) Hope College Departments of Chemistry and Geological and Environmental Sciences

A collection of North American feldspar minerals were examined using cold-cathode cathodoluminescence (CL) spectroscopy. The resulting spectra were fit and characteristic peaks were associated with each feldspar phase; these peaks are independent of geographic origin. Most of these peaks have been previously assigned to luminescent centers, such as Mn²⁺ and Fe³⁺, and structural defects. While the magnitude of these peaks depends on many co-factors, the peak centroids are shown to be consistent for replicate samples from any given location. These peak centroids are also found to vary measurably from location to location, most likely due to stoichiometric changes in the Na-K-Ca composition of the feldspars. A relationship between CL peak centroid and lattice size changes for both alkali and plagioclase feldspars has been reported previously. This novel application of an older luminescence technique yields encouraging results for the practical application of feldspar identification and provenance attribution in forensic geology.

Funding for this project is provided by the National Science Foundation (RUI PHY-0969058; MRI 0319523) and the Department of Homeland Security (2008-DN-077-ER0008). This project is based on previous work by Sarah Brokus and Danielle Silletti in cooperation with the FBI Visiting Scientist program administered by ORISE. Points of view presented are those of the authors and do not necessarily represent the official position of the FBI or the US Government.

Framework for Depth of Procedural Understanding of Mathematics Solutions: Assessing student explanations

Emily Rowland

Mentor: Dr. Vicki-Lynne Holmes Mathematics Department

The purpose of this mixed method analysis was to provide a mathematics framework for classifying metacognitive steps that exemplify levels of student comprehension of procedural problems. By analyzing preexisting student work from several studies with common themes of conceptualizing procedural problems using metacognition, the study sought to categorize depth of students metacognition levels and create a common verbiage that teachers can use to assess students comprehension. This research determined that this depth of knowledge can be framed in a three-tiered hierarchy *-- basic understanding, extended understanding,* and *extensive comprehension*. Each level is defined by three pivotal factors that assist in increasing the depth of student knowledge of procedural processes. Vocabulary usage (effect size $\beta = .18$), stating procedural processes (effect size $\beta = .18$), stating procedural processes (effect size $\beta = .18$), rocedural steps explained, and connected concepts (extensions) increased, so did the quality of a students' procedural explanations. Individually these instructional practices deepen understanding of procedural steps; moreover by integrating these practices, the student benefits almost doubled (r =.91). Thus having students include mathematics vocabulary in their explanations of their step by step procedural processes and relating this knowledge to other mathematical concepts brought a deepening of understanding the procedural processes.

Modeling Marram Grass Population Dynamics in a Coastal Dune System

Leah LaBarge and Connor Mulcahy

Mentors: Drs. Brian Yurk and Edward Hansen Departments of Mathematics and Geology

Marram grass (*Annophila breviligulata*) is a dune pioneer species that thrives with burial by sand. It plays a critical role in controlling the growth and migration of coastal dunes because it anchors the surface with its roots and slows the wind, reducing erosion. As a first step in developing a general mathematical model for sand dune migration, we developed models of marram grass population dynamics. In the simplest case, we used a nonlinear difference equation to account for the effects of burial on population growth rate. This model predicts that the population will evolve to a stable steady state at low values of burial and will undergo periodic behavior at high levels of burial. We expanded this model into a system of nonlinear difference equations by incorporating an equation describing soil quality degradation due to the presence of plants (plants consume soil nutrients, take up space, and introduce harmful microbes) and soil quality improvement due to the influx of fresh sediment (burial). Population growth rate is then determined by the soil quality and plant density. In this case, we found plant-free and plant-present steady states and determined their stability under different burial conditions. We discovered that our equilibrium plant population has a critical point, implying there is a maximum equilibrium population of plants. Using \sc{Matlab} we simulated several scenarios, suggested by our steady state analysis, by changing soil quality parameters and the relative amounts of burial and effective soil depth. In our final model we incorporate spatial dynamics by extending our nonlinear difference equation model to a system of integro-difference equations. This model accounts for the plants ability to spread out horizontally through reproduction.

This research was supported by the Michigan Space Grant Consortium.

MATHEMATICS

Predicting Insect Development in Changing Climates: Bean Beetle (Callosobruchus maculatus) Phenology Modeling

Joseph Adamson

Mentors: Drs. Brian Yurk and Aaron Putzke Departments of Mathematics and Biology

Temperature-dependent development time models are useful tools for predicting population dynamics (including range expansion) and managing insect populations under changing temperatures. Sharpe and DeMichele (1977) proposed a model based on equilibrium enzyme kinetics to explain the dependence of insect phenology on varying temperatures. We fit their model to constant temperature development time data for bean beetles (*Callosobruchus maculatus*), that we measured in laboratory experiments, and used the model to predict development time under varying temperatures. Bean beetles are an important agricultural pest insect in Africa and Southeast Asia that has begun to infest crops in Europe and North America. We are currently working to extend the Sharpe DeMichele model to account for non-equilibrium enzyme kinetics, particularly at low temperatures, in order to more accurately predict the timing of developmental events in the bean beetle.

This material is based on work supported by the National Science Foundation and the Hope College Dean of Natural Sciences.

Using Regional Data to Correlate Program Effectiveness: Delta Math as a case study: The effects of the Delta Math Response to Intervention program on student achievement

Nicholas Haugen

Mentor: Dr. Vicki-Lynn Holmes Department of Mathematics and Department of Education

The purpose of this quantitative study was to determine the effects of the Delta Math Response to Intervention Program on student achievement as defined by mathematics scores on the State (MEAP) assessments. Previous to this study, only anecdotal data existed to support the success of Delta Math, a standards based (both the Common Core State Standards and Michigan's Grade Level Content Expectations) program that provides schools with tools to identify individual learning gaps and protocols for responding to targeted student needs. Data from 65,697 K-8 grade students from 265 schools in 29 Michigan counties was analyzed to ascertain the overall effect of Delta Math Readiness Standards on math MEAP scores as well as grade level effect sizes. The study found that there was a large, positive, correlation between success in Delta Math and success on the math MEAP; and that Delta Math has a greater impact on MEAP performance for Grades 3-6. An overview of the Delta math program is also discussed.

This research was supported by the Michigan Department of Education Regional Data Initiative and Howard Hughes Medical Institute

Modeling the Formation of Sand Ripples: Gone with the Wind

Eric Greve and Jacob Jeffers Mentor: Dr. Tim Pennings Department of Mathematics

Why does a wind blowing over a sandy surface establish ripples of uniform size, shape, and separation, rather than leveling the surface? Previous models, motivated by wind tunnel observations, have explained this by relying on the accumulation of saltating sand particles. Observing sand in its natural environment; however, indicates otherwise. Our model explains the formation of these ripples based only on reptating sand particles. The results of this model call into question the validity of these previous models.

This research was supported by the NSF #0645887.

The Ubiquitination Status of System xc- is Regulated by the Oxidative State of the Cell

Elizabeth Hidlebaugh, and NaTasha Schiller

Faculty Mentor: Dr. Leah Chase Department of Biochemistry

System xc- is a plasma membrane transport system that catalyzes the stoichiometric exchange of extracellular cystine for intracellular glutamate in many cell types. It is made of two proteins, xCT and 4F2HC. Previous studies of this transporter in my lab have demonstrated that oxidants trigger a rapid increase in cell surface expression and activity of System xc-, which increases the intracellular levels of cysteine, allowing for the recovery of cellular glutathione levels within 90 min of oxidant exposure. Ubiquitination is a common mechanism for regulating cell surface expression of many plasma membrane proteins, including both ion channels and transporters. We have recently demonstrated that endogenous xCT expressed in cultured U138MG cells is ubiquitinated using a co-immunoprecipitation assay. Cultured U138MG cells were treated with either vehicle or hydrogen peroxide for 10 min and the cell lysates were immunoprecipited an anti-ubiquitin antibody and probed with anti-xCT. Vehicle-treated samples exhibited strong immunoreactivity at approximately 70 kD, 90 kD and 100 kD (Fig. 1A). These bands suggest that xCT is either multi-ubiquitinated or poly-ubiquitinated. However, only 18% of the immunoreactivity from 65-200 kD region could be detected in the peroxide-treated sample in relation to the control sample, despite the fact that all samples were normalized for protein content prior to immunoprecipitation. These preliminary data suggest that xCT is ubiquitinated under basal conditions. In addition, H2O2 appears to decrease the ubiquitination of xCT, which may regulate its cell surface expression.

Intracellular Localization of System x_c^- using Sub-cellular Fractionation.

Kyle Mckey and Andrew Dolehanty

Mentor: Dr. Leah Chase Department of Biochemistry

System x_c^- , a membrane transport system that exchanges intracellular glutamate for extracellular cystine, has been shown to traffic constitutively between intracellular vesicles and the plasma membrane. Oxidants, which rapidly increase membrane expression of system x_c^- , are thought to manipulate this trafficking mechanism, enabling the cell to rapidly respond to oxidative stress. The fractionation study sought to determine the sub-cellular location of system x_c^- under basal conditions and when treated with peroxide. A continuous density gradient and centrifugation allowed for the intracellular species of U138 cells to separate due to their different membrane densities. Fractions from the gradient were collected and analyzed using western blotting and immunoassaying protocols. Initial analysis of the data shows multiple molecular weight bands at the higher densities in both control and peroxide treatments, which suggests that system x_c^- goes through modifications when present at that particular cellular location. In addition, there is less total system x_c^- in the lower density fractions of the peroxide treatments, corroborating our previous membrane biotinylations studies that suggested the system is moving from its intracellular locations to the membrane. Currently we are focusing on identifying the golgi, endoplasmic membrane and endosome fractions using known immuno-markerassays to better understand the intracellular trafficking patterns of System x_c^- .
Real Time Analysis of Protein xCT in System ${\rm x}_{\rm c-}$

Cassondra Cramer, Anne Georges, NaTasha Schiller Mentor: Dr. Leah Chase Department of Chemistry, Department of Biology, Department of Neuroscience

System x_{c} is a plasma transport system that catalyzes the stoichiometric exchange of extracellular cystine for intracellular glutamate, which is then reduced to glutathione. Glutathione, an antioxidant, neutralizes reactive oxidant species (ROS) formed as a byproduct of cellular respiration. An imbalance of ROS in a cell causes oxidative stress, which can lead to cell death. Protein xCT functions in the unit of System x_{c} and preliminary data show oxidants increase the trafficking of xCT to the cellular membrane. Understanding how this trafficking event happens in real time will answer questions of how quickly cells begin to respond to an oxidative assault and how this response is mediated. To answer this question a fusion protein of GFP-xCT was transfected and is stably expressed in U138MG cells. Live cell imaging reveals xCT localized in intracellular vesicles in a non-oxidative stress treatment and shows traffick to the membrane when H_2O_2 is introduced to the cell media. Additionally Western blot analysis shows this construct protein trafficks the same as the native protein.

Activation of System xc- Trafficking via an Akt-dependent Signal Transduction Pathway

Daniel A. Smith, NaTasha Schiller, and Mary C. Bradley Mentor: Dr. Leah Chase Departments of Biology and Chemistry

System xc- is a heterodimeric plasma membrane transporter involved in the exchange of intracellular glutamate for extracellular cystine. As such, this transporter plays a critical role in the production of the antioxidant glutathione. Previous studies in our lab have demonstrated that there is an increase in cell surface expression within ten minutes of exposure to H2O2 in confluent U138MG human glioma cells. The study described herein sought to begin to characterize the mechanism by which H2O2 regulates the trafficking of xCT. We hypothesized that Akt signaling is necessary for H2O2-mediated trafficking of of xCT. A significant increase in Akt phosphorylation was observed in U138MG cells following ten-minute exposure to 3 mM H2O2 compared to vehicle-treated cells using western blot analysis. Treatment with the Akt inhibitor 10-DEBC (2.5μ M) for 30 minutes prior to and during H2O2 exposure resulted in a decrease in H2O2-induced phosphorylation of Akt at Ser473. Similar inhibition of Akt phosphorylation at Thr308 was observed following treatment of cells with 1.0 μ M API-2. Next, we used simultaneous treatment of cultured glioma cells with both inhibitors in the presence of H2O2 to determine if such treatment led to a reduction in the trafficking of xCT to the plasma membrane. Our preliminary data suggests that Akt activation is necessary for H2O2-induced trafficking xCT to the plasma membrane.

This research was supported by the National Science Foundation RUI grant 0843564.

Cold Acclimation and Central Administration of Homocysteic Acid in Rats: A Potential Model for Schizophrenia

Christopher Davis, Guillermo Flores, John Kemink, Jacqueline Logan, Mara McMurray, Lauren Reif, Aaron Sayfie, Catherine Strahle and Allyssa Wagner

Mentors: Drs. Christopher Barney and Leah Chase Department of Biology and Neuroscience Program

Homocysteic acid (HCA) is a neurotoxin and a NMDA receptor agonist that is taken up in GABAergic interneurons by the cystine/glutamate exchanger, System xc-, and then slowly released. We thus hypothesized that HCA may trigger a slowly developing neurodegeneration of GABAergic interneurons, which might serve as a model for schizophrenia. In addition, we hypothesized that cold acclimation would exacerbate the effects of the HCA. In this study, HCA was injected bilaterally into the lateral cerebral ventricles of rats. Two days later half of the rats were placed in a 5°C environmental chamber. Behavioral testing for motor performance, anxiety, social interaction, hedonistic behavior, and spatial learning and memory began three weeks later. Cold acclimation reduced body weight gain, motor performance and exploratory behavior while HCA decreased exploratory behavior. Neither cold acclimation nor HCA altered spatial learning or memory or social interaction. Both cold acclimation and HCA for any behavioral test. These results indicate that both central administration of HCA and cold acclimation can alter performance in behavioral tests that may relate to schizophrenia-like behavior in rats but cold acclimation does not potentiate the effects of HCA.

Connecting the Dots: Finding a Unified Theory of Laterality and Modality in Metaphor Comprehension

Erika Dvorak, Jonathan Snavely, and Michael Harper

Mentor: Dr. Gwenda L.Schmidt Department of Neuroscience

Previous research in the neural processing of language has demonstrated that both the right and left hemispheres are involved in the processing of figurative language such as metaphors, idioms, and even humor. Specifically, it has been suggested that the left hemisphere plays a vital role in the processing of literal or more concrete language, while the right hemisphere specializes in processing and integration of language with multiple meanings. However, little research has been conducted investigating how motion and auditory-based figurative language is processed in each hemisphere. Our study was intended to eliminate confounds evident in previous research by controlling for familiarity, naturalness, and imageability of the stimuli presented. A computer program was used to display sentences to participants to either the left or right visual field. Event-related potentials (ERPs) were measured using an EEG system. The N400, our dependant measure, is a negative waveform component of the ERP, which occurs approximately 400 milliseconds post-stimulus and indexes semantic processing difficulty. Stimuli were divided into literal, metaphoric, and anomalous sentences. In addition, the stimuli were equally divided between auditory and motion modalities. Our results confirmed our hypothesis that there would be greater N400 amplitudes for anomalous and metaphorical sentences. In addition to the N400 differences between conditions, we also found a right hemisphere bias when metaphorical sentences were presented, confirming our hypothesis that there would be an interaction effect between visual field and figurativeness. Further assessment of specific scalp locations showed decreased activation in the parietal region when auditory metaphor sentences were presented to the left hemisphere specifically. This suggests there is a significant modality component to figurative language processing. These results are in accordance with existing theories of right hemisphere language involvement, suggesting there is a hemispheric bias when processing literal and metaphoric language, though not as definitive as previously thought.

Characterization of C-terminal Motifs which may Regulate the Trafficking of System x_c⁻

Anne Georges

Mentor: Dr. Leah Chase Departments of Biology and Chemistry

System x_c , a plasma membrane transport system that exchanges intracellular glutamate for extracellular cystine, has been shown to traffic constitutively between intracellular vesicles and the plasma membrane. Oxidants, which rapidly increase plasma membrane expression of system x_c in confluent cell cultures, are thought to manipulate this trafficking mechanism, enabling the cell to rapidly respond to oxidative stress. Trafficking is a common form of regulation among transport proteins, and various amino acid motifs, often located near the carboxyl terminus, have been shown to play integral roles in the trafficking mechanisms of these transporters. This study sought to identify amino acids within xCT, the transport-specific protein of system x_c, that are involved in its trafficking. Carboxyl-terminal truncations and point mutants of xCT were constructed in a FLAG-tagged cDNA vector and stably expressed in PC12 cells, a rat pheochromocytoma cell line. The trafficking behavior of the mutant constructs, under both normal and oxidative conditions, was assessed using immunofluorescence microscopy, ¹⁴C-cystine uptake assays, and a biotinylation protocol that separates cell surface proteins from intracellular proteins. Our preliminary data suggest that deletion of 42 amino acids from the C-terminus leads to a constitutive increase in cell surface expression, suggesting that the C-terminus may be involved in constitutive endocytosis or intracellular sequestration of system x. In order to further characterize the role of this region, rates of delivery and recovery of the system to the plasma membrane were assessed under both normal and oxidative conditions. To identify the specific trafficking motifs, putative endoctyic motifs within the truncation region were identified and single-point mutagenesis was used to evaluate each motif. Identification of the trafficking motifs within xCT will enable a better understanding of the signaling pathways that control both the constitutive and regulated trafficking of this transporter which functions to maintain oxidative homeostasis within the cell.

This research was supported by the Arnold and Mable Beckman Foundation and NSF RUI # 0843564.

Oxidative Stress Causes Modifications and Decreased Function of System x_c⁻

Matt Hartwell and Jenna Sutton

Mentor: Dr. Leah Chase Department of Chemistry

Oxidative stress represents an imbalance between the production of reactive oxygen species, and their removal by antioxidants. System x_c is a plasma membrane transport system that exchanges intracellular glutamate for extracellular cystine, a precursor to cysteine, the limiting reagent for glutathione production. As glutathione is an endogeneous antioxidant, system x, plays a key role in combating oxidative stress. Previously, our lab has observed using western blot analysis that a fraction of xCT shifts to a higher molecular weight form after hydrogen peroxide exposure. As hydrogen peroxide produces free radicals, we believe xCT is oxidized, therefore decreasing its function. Two methods are being taken to observe oxidation, biochemical strategies in our lab and mass spectroscopy done at the Fred Hutchinson Cancer Research Center Proteomics Core. Biochemical strategies include DNPH assays to detect the presence of carbonyls after oxidative stress, and glutathiolation assays to detect the presence of glutathiolated proteins. Results indicate that xCT is oxidized. In addition to oxidation, we found that xCT is glutathiolated, which could have a variety of effects. xCT may be glutathionylated on cysteine residues and form high molecular weight multimers as a result of cross-linking by reactive cyteine residues. It is also possible that reactive cysteinyl thiols may undergo glutathiolation reactions to act as an on/off switch in response to oxidative insult with the effect of initiating and depleting signal transduction pathways. Mass spectroscopy will help identify specific locations of oxidation and glutathiolation. Once targets are identifies, a combination of site-directed mutagenesis and mass spectroscopy will be used to identify critical residues that are modified after oxidative stress.

Neural Correlates of Implicit and Explicit Metaphors: An ERP Study

Erin Hildebrandt, Amanda Layman, Davis Vanderveen, and Audrey Weil Mentor: Dr. Gwenda Schmidt Department of Neuroscience

Due to the often unfamiliar nature of metaphors as well as the greater semantic distance between the two concepts being linked, many have hypothesized that figurative language is processed in the right hemisphere (RH) (Jung-Beeman, 2005; Schmidtet al., 2007). However, there have been many contradictory findings in this regard. One factor not previously considered is the existence of different type of metaphors such as implicit metaphors (IM) and explicit metaphors (EM). Our goal was to examine how EM (The veteran professor was a fossil) differ from IM (The teenagers could not relate to the fossil) in their neural processing. Understanding the implicit meaning of a sentence may draw on additional cognitive resources, thereby affecting the difficulty, and perhaps neural pathways involved in processing these sentences. We also wanted determine if the RH is specialized for metaphor processing. We used event-related potentials (ERP) in conjunction with divided visual field presentation to measure the N400 for each sentence as presented to each hemisphere of the brain. ERPs are derived from electroencephalographic (EEG) recordings from the scalp. The N400 is a peak of negative brain activity occurring approximately 400ms after a word, which indexes the ease of semantic processing. We can measure differences in neural processing by observing differences in N400 amplitude across visual field presentation. We conducted an ANOVA with factors of figurativeness, implicitness, and side of presentation using the N400 amplitude as the dependent measure. When IM were presented to the RH, the N400s measured by the parietal lobe electrodes were about the same as those for EM. The left hemisphere (LH) presentation showed much larger N400s for IM than for EM. This suggests that the LH is less efficient at processing IM in comparison to EM while the RH can do both equally well.



Homocysteic Acid Treatment in Rats to Determine Gender Differences and Possible Development of a Novel Schizophrenic Model

Philip Zuska, Lindsay Schell, Michael Parrish, Kelsey Moore, Elizabeth Fast, Ashley Drew, Andrea Dimet, Sharina-Mae Bello, and Lydia Baxter-Potter

Mentor: Dr. Christopher Barney Department of Biology

Schizophrenia is a universal and debilitating disease with approximately 1 out of every 100 people experiencing symptoms at some point during their lifetime. Although the etiology of the disorder remains elusive and is believed to be complex and multi factorial, the positive psychotic symptoms of the disorder are believed to arise from disruptions in the dopamine neurotransmitter system, of which the glutamatergic neurotransmitter system is responsible for inhibiting. It has been found that schizophrenics have high circulating levels of the chemical homocysteine, which is the precursor to homocysteic acid. Homocysteic acid (HCA) is known to be taken up by the trafficking System xc-, where it is sequestered then slowly released, resulting in excitatory toxicity in NMDA receptors. The death of these dopamine-inhibiting cells could potentially result in an overactive dopamine system, leading to the development of schizophrenic-like symptoms. In this study we aimed to not only evaluate the efficacy of HCA administration as a schizophrenic model, but also whether there are sex-specific HCA effects as well as general behavioral differences between the sexes. Specifically, we evaluated the effects of sex and HCA treatment on social behavior, cognitive functioning and spatial learning and memory, anxiety level, sensorimotor gating and habituation, motor movement and coordination, hedonistic drives, and body weight by first performing intracerebroventricular injects of HCA and subsequent behavioral analyses. Although our results do not indicate a significant effect of HCA on these measurements of schizophrenic-like symptoms, there were expected sex-dependent and other previously documented outcomes. Further studies using a larger sample size and refined experimental techniques would be beneficial in determining the efficacy of elevated HCA as a model for schizophrenic-like symptoms.

The Relationship of Nurse Navigator With Timeliness of Diagnosis and Date of Surgery in Breast Cancer Patients

Allison Spyke

Mentors: Geralyn Roobol, Loril Garrett and Dr. Susan Dunn Spectrum Health and Department of Nursing

Nurse navigators are patient advocates, care coordinators, and educators that aim to improve continuity and quality of care for patients. Nurse navigation is becoming an essential part of patient care in the field of oncology. This study examined the relationship of nurse navigators with the timeliness of diagnosis and date of surgery. The purpose was to describe the role of a nurse navigator specifically in relationship to the timeliness of diagnosis in breast cancer patients who are going to be receiving surgery. The foundation of this research is based on Jean Watson's Caring Theory, taking into consideration the nurse-patient role as an interpersonal helping-trust relationship that provides a sense of faith and hope for the client. This study was carried out using a between-subjects design via chart review to compare two time periods, before and after the initiation of a nurse navigator with breast cancer patients. Research was conducted at a level three hospital in West Michigan. Participants included those who had surgery for breast cancer with an oncology consultation to follow. Clients were drawn from the nine-month period before the initiation of the nurse navigation, October 2008 to June 2009 and the nine-month period following implementation of nurse navigation, July 2009 to April 2010. There were 308 participants who received the nurse navigator and 192 participants who did not receive the nurse navigator. Data was collected from the Cancer Registry and chart review from the hospital's charting system. Data analysis was completed using PASW 17.0 statistical software. Statistical analyses showed that the average number of days from date of diagnosis to date of surgery in patients was significantly shorter in those who received a nurse navigator. The mean number of days from diagnosis to surgery in patients who received a navigator was 192 days while the mean number of days for non-navigator patients was 306 days. A limitation of the study is data was limited to one hospital. Study findings show the relationship of nurse navigation and timeliness of surgery after diagnosis. Findings can be used to educate nurses about the impact of nurse navigation on outcomes.

Patient Satisfaction Initiative: Phase II, Bedside Hand-off Report

Catherine Stilwell

Mentors: Marcy Achterhof and Dr. Susan Dunn

Holland Hospital Emergency Department and Department of Nursing

Patient satisfaction scores in a nationally recognized Midwestern hospital's Emergency Department are receiving attention from leadership and staff. This department strives to achieve higher patient satisfaction scores by transitioning hand-off report from the nurse's station to the bedside. The purpose of this descriptive study was to analyze the influence of bedside report on patient satisfaction in the Emergency Department. A one-month pilot study, comprised of patients cared for by three nurses and their report with oncoming nurses was conducted. Jean Watson's Theory of Human Caring provided a foundation for the interviews of patient's perceptions. A questionnaire was given to the patients whose nurses participated in bedside report. The questionnaire was both qualitative and quantitative in nature. A category scheme was developed to organize qualitative data into themes. Quantitative data was analyzed with SPSS 17.0 Statistical Software®, with a p-value set at greater than .05 for all tests. Results and conclusions are pending. Data collection from only one department and one hospital is a limitation for this project. A small sample size prohibits the generalization of results to other hospitals. These findings could provide nurses with a report technique that will better satisfy the patient. Future research could focus on the difference in patient satisfaction scores while using different methods of bedside report.

The Use of Celebrex for Postoperative Total Knee Replacement Patients

Amanda Sutton

Mentors: Kristie Dennett, Holland Hospital and Dr. Nancy Barnum Department of Nursing

Knee replacement surgeries are prevalent among the elderly population, and postoperative pain is still not being managed appropriately in many cases, leading to prolonged hospital stays and ineffective physical therapy and rehabilitation efforts. Celebrex (Celecoxib) is a nonsteroidal anti-inflammatory drug that has been shown to reduce pain and inflammation in osteoarthritis and postsurgical patients. The purpose of this research is to examine the effectiveness of Celebrex administration on reducing pain and improving range of motion in total knee replacement patients at a Midwest hospital. The conceptual framework for this study was Katharine Kolcaba, which focuses on providing the patient comfort, including pain relief, in order to facilitate holistic healing. This study is a quantitative, retrospective, cross-sectional, quasi-experimental study with a random sample of 30 patients in the control group, and 30 patients in the experimental group. The data was collected through chart review at the hospital. SPSS statistical software was used to examine frequencies and Pearson r correlations and to run independent t-tests. Results and conclusions are pending. Limitations of the study include having a small sample size, inconsistent medications and dosages given in addition to Celebrex, and subjective nature of pain reports. Implications for future study include modifying dosage of Celebrex and other pain medications given, using nursing care to proactively manage pain, and efficacy of alternative pain management techniques.

The Use of Telemonitoring in Reducing Rehospitalizations

Amy Veltkamp

Mentors: Kelly Wierenga and Dr. Susan Dunn Department of Nursing

Patients who are readmitted to the hospital for chronic illnesses are contributing to increasing health care costs. One approach to reducing this "revolving door" problem is the use of telemonitoring. Telemonitoring systems record vital signs and other data in the patient's home and transmit the data electronically to the health care provider. The purpose of this research project was to examine the use of a telemonitoring system in preventing rehospitalizations in patients who had received home health care. The project was based on Dorothea Orem's theoretical framework, which addresses the role of the nurse in enabling patients to perform self care. Data was collected through a retrospective chart review at a home health care agency in West Michigan. Charts of 31 patients who had used telemonitoring and had been rehospitalized between January 2011 and August 2011 were used. Common diagnoses included diabetes, hypertension, coronary artery disease, chronic obstructive pulmonary disease, and congestive heart failure. Data was analyzed using SPSS statistical software. Results of the study showed that patients were most likely to be rehospitalized during the first week of using telemonitoring. The findings also showed that physicians were contacted less than 40% of the time prior to rehospitalization and that when a physician was contacted, they sent the patient to the emergency room 70% of the time. Limitations of this study include small sample size and using only one agency for data collection. Future research is needed to identify better ways to utilize telemonitoring technology to prevent rehospitalization and to compare differences between patients who are rehospitalized and those who are not.

Relationship of Activity Status Prior to Experiencing a Cardiac Event and Levels of State and Trait Hopelessness

Tracy DeKoekkoek

Mentors: Drs. Susan Dunn and Barbara Vincensi Department of Nursing

Several studies exist that examine the relationship of hopelessness and depression in individuals after they have experienced a cardiac event; however, few examine the relationship of hopelessness and exercise prior to an acute exacerbation of cardiac heart disease (CHD). The purpose of this project was to evaluate the relationship between an individual's activity status prior to their cardiac event and the level of both state and trait hopelessness they reported while in the hospital. Abramson's Theory of Hopelessness Depression was used as a guide for this research, as this model distinguishes hopelessness from depression. Hopelessness is feelings of uncertainty or negativity towards one's future and can be evaluated independent of depression. This non-experimental study collected data using the Duke Activity Status Index and the Dunn-Tintle State/Trait Hopelessness Scale. Data collection occurred in acute care setting at patients bedside by senior nursing students and nursing faculty. The sample included 520 cardiac patients with CHD who were enrolled into the study during their stay on either of two cardiac units at a large teaching hospital in West Michigan, and who were to be discharged to a home setting. Limitations to the study include the data was collected at only one hospital and the lack of ethnic diversity within the sample. Data was analyzed with SPSS 19.0 Statistical® software. Results and conclusions are pending. Expected analysis includes descriptive statistics and correlations. These study results may include education for nurses to further encourage participation in cardiac rehabilitation exercise after a CHD event, education regarding assessment, prevention, and treatment of feelings of hopelessness in CHD patients, and basis for further research.

Evaluation of Outcomes of Post Hip-Fracture Patients with Osteoporosis

Elizabeth Higginbotham

Mentors: Anne McKay and Dr. Barbara Vincensi Holland Hospital Bone Health Program and Department of Nursing

Osteoporosis is a debilitating disease that is often undertreated. The purpose of this study is to determine if patients with fragility hip fractures admitted to a small hospital in western Michigan receive the standard of post-fracture osteoporosisrelated care as outlined in the "Own the Bone" initiative. The framework used is Roy's Adaptation Model, because it stresses the importance of a supportive environment to prevent hip fractures caused by osteoporosis. This study is a descriptive retrospective review of electronic medical records of patients that suffered a hip fracture between January and July 2011. A total of 44 post hip fracture patient's charts were analyzed using frequencies and t-tests in SPSS 19.0. Limitations of this project include: data collection from a single hospital, missing data of patients lost to follow-up, unable to trace patients receiving follow-up care at outside clinics. Results show that only 7% of the patients with critical vitamin D levels were redrawn. Only 20% of patients had any record of a bone density scan. Conclusions show the standard of care for post hip fracture patients is not being met. Health care providers need to be more vigilant about treating osteoporosis in order to prevent hip fractures in the window of opportunity so that patients are not lost to follow up.

Student Needs and Expectations of Services Offered at a College Health Center

Cara Bartels

Mentors: Carolyn Mossing and Dr. Nancy Barnum Hope College Student Health Center and Department of Nursing

College health services provide basic care addressing students' physical and mental health needs. Many college students however are unaware of the health resources that their college provides through a health center. The purpose of this study is to determine the perceptions and knowledge of college students regarding the care being delivered at one college health center. The nursing framework that has shaped this study is Dorothea Orem's Self-Care Theory, which emphasizes the importance of helping patients regain normal state of health so that they can meet their own self care needs. This study is a non-experimental, cross sectional, needs assessment that will be evaluated through the means of a survey, which will be sent out to all students 3249 via email. The survey includes questions about demographics, use of the health center, knowledge about the health center, self health behaviors, health educational needs, and interest in health education. Descriptive statistics, frequency, central tendency, variability, cross-tabulations, and correlation will be performed using SPSS. Results and conclusions are pending. Limitations of this study will be a possible response bias by students who choose to respond to the survey and data will only be collected from one school. A future implication for this study is the improved nursing care that the college health center will be able to deliver to students.

The Period of PURPLE Crying to Prevent Shaken Baby Syndrome

Abby Branderhorst

Mentors: Joyce Van Hoff, Holland Hospital and Dr. Nancy Barnum Department of Nursing

Shaken baby syndrome (SBS) is defined as inflicted brain trauma in an infant as a caregiver reaction to persistent crying, and is associated with negative complications. Prior intervention programs have proven effective in reducing SBS. The purpose of this project was to perform a comprehensive literature review to determine if the prevention program of "The Period of PURPLE Crying" reduces SBS. An extensive review of nursing literature was completed with CINAHL and MEDLINE, using the keywords of shaken baby syndrome, inflicted brain trauma, PURPLE crying, and the period of PURPLE crying. The search yielded twelve manuscripts that focused on either shaken baby syndrome or prevention programs for SBS. The level of evidence is moderate, with one article classified as a single, random, controlled trial; two articles as well-designed nonrandom controlled trials; four articles as well-designed case-control and cohort studies; two articles as systematic reviews of qualitative studies; and one article as a single descriptive or qualitative study. Information was then synthesized to identify major trends and gaps. The literature provided evidence that "The Period of PURPLE Crying" program has resulted in increased caregiver knowledge about infant crying and shaking. Also, following participation in the program, caregivers have shared advice relative to walking away if frustrated by an infant's crying. The project was limited by the few number of research manuscripts focused specifically on the topic. This literature review will be used as a foundation in the research design of a future study, in particular in the development of a data collection tool. Nursing research is needed to confirm the effectiveness of "The Period of PURPLE Crying" program in decreasing the incidence of SBS.

Emergency Room Use in the Healthy Beginnings Program

Alexandra Egedy, John Vanderveen, Emily Staley, and Angelina Matthews

Mentors: Professor Vicki Voskuil and Dr. Sonja Trent-Brown Departments of Nursing and Psychology

The Ready For School Healthy Beginnings project aims to increase access to healthcare by establishing a medical home for all children ages birth through five in regional opportunity zones. The intervention program at two pilot sites utilizes a case manager (RN) and a community health worker to increase access to medical care for at risk children. Participants in the Healthy Beginnings program numbered 1375 children between the ages of 0-5. Emergency room (ER) visits, urgent care facility visits and hospital inpatient admissions were tracked across the children to determine the patterns of use with respect to time of day and diagnosis. Data were accessed from reports generated by the local hospitals and urgent care sites. Results showed that for program participants who used the emergency room those visits often occurred between the hours of 8 a.m. and 5 p.m. during the hours of operation of the child's medical home. Additionally, some of the emergency room visits occurred between 5 p.m. and 8 p.m. during extended clinic hours for the patients' medical home. Of the indicated diagnoses, there was evidence that some of the participants used the ER as a primary healthcare facility. The most common emergency room diagnoses included respiratory and gastrointestinal maladies. The results from baseline data indicate areas of parental education are needed in order to decrease overuse of the emergency room. Parent education should include orientation to clinic hours to limit ER use when the medical home is open, ensuring that parents know when an ER visit is necessary versus going to the medical home in order to limit diagnoses such as "well-child" and "unspecified" and should emphasize the importance of calling the medical home prior to an ER visit in order to determine whether the clinic can serve the patient's needs.

This research is supported by the Kellogg Foundation and the Hope College-Howard Hughes Medical Institute Faculty Department for Interdisciplinary Research.

Sleeping at Night Offers Opportunity for Zest and Energy (SNOOZE): Part 2

Amber Graeser

Mentors: Molly Christians, Spectrum Health and Dr. Susan Dunn Department of Nursing

Because of noise, lights, and patient care, sleep deprivation in acute care settings can jeopardize improved patient outcomes and satisfaction. Many studies focus on patient sleep in intensive care units but limited research has examined medicalsurgical units. The SNOOZE nursing intervention promotes patient preferences in sleep routine, grouping patient care through nurse coordinated care, decreasing noise, and sleep tracking between the hours of 2100 and 0600. As nursing staff implement sleep promoting activities, the purpose of this study was to identify staff perceptions on units implementing the SNOOZE intervention in the areas of teamwork, relationships, satisfaction with quality of care they provide and team behaviors. Martha Roger's Science of Unitary Human Beings conceptual model was used as a foundation to this study as both the environment and person interact, and change in one will result in change in the other. Nursing staff members were invited to complete a pre- and post-survey. Twenty-seven pre-surveys and twenty-nine post-surveys were completed on two medical-surgical units at a Midwestern hospital in Michigan using a convenience sample. Data was analyzed using SPS statistical software. Significant correlations were found pre- to post-survey; however, no significant differences were found pre- and post-survey. This indicates that the SNOOZE intervention promoted addressing nursing care interventions throughout the night. Limitations include a small convenience sample, less than 50% response rate, limited responses offered on the survey, data collected at one hospital, and unknown validity of survey. Study findings can be used to educate nursing staff on the benefits of the SNOOZE nursing intervention. Future research should increase sample size and focus on night shift nurses.

Components of Nurse Handoff Report

Andrea Karnik

Mentors: Marie VanderKooi, Karen Vander Laan and Dr. Susan Dunn Spectrum Health and Department of Nursing

Traditionally, nurses meet at the change of their work shift to discuss the patients for whom they will be providing care. This is called handoff report. The opportunity for this study arose with a health system's transition to computerized provider order entry. This study revolved around the transition from a paper kardex to a self-generating electronic kardex, which both can be used as a part of report. The purpose of this study was to describe the extent to which the components of nurse handoff report are duplicated on a paper kardex or an electronic kardex, and to describe the components of nurse handoff report as they relate to nurse-sensitive indicators. The framework used was the Data-Information-Knowledge-Wisdom Framework. Ten nurses were observed during report on different patient units at two hospitals in a West Michigan healthcare system. These ten nurses were observed again after the transition. Microsoft Excel and SPSS statistical software were used for data analysis. It was found that more components of report were included in the electronic kardex and 23.4% of report related to nurse-sensitive indicators. This shows that the electronic kardex contained more information, but it did not significantly change the content of report. Limitations of this study include a convenience sample and potential for missed information related to hand-recording of observations. Findings from this project can be used to educate nurses at this hospital about the percentage of nurse-sensitive indicators discussed in handoff report. The amount of duplication with the electronic kardex also implies that other topics can be discussed in handoff report. Future research can test interventions to increase the percentage of nurse-sensitive indicators discussed in handoff report.

Effectiveness of Celebrex on Total Hip Replacement Patients

Esther Moon

Mentors: Kristie Dennett and Dr. Nancy Barnum Holland Hospital and Department of Nursing

A postoperative pain score has been a helpful too for identifying a patient's level of pain during hospitalization. Using nonsteroidal anti-inflammatory drugs (NSAIDs) are one of the ways of relieving pain for patients with arthritis who have undergone total joint replacement surgeries. The purpose of this research is to examine the effectiveness of Celebrex in reducing pain, and enhancing patient performance in post-operative patients. The conceptual model for this study is Pender's Health Promotion Model as it emphasizes how health promotion, in this case the pain control management, is targeted to increase client's level of wellbeing and functional ability. This is a quantitative, cross-sectional, retrospective study with randomly-selected sample size of 60 patients between the ages of 50 and 90 years old who underwent a total hip replacement surgery in 2010 and 2011. The data was collected through a chart review on a joint replacement unit of a hospital in West Michigan. Gender, age, visual analog scale (VAS) pain scores, length of stay, and single longest distance walked were measured. Descriptive statistics, independent t-test, and mean pain scores will be examined using SPSS statistical software. Results and conclusions are pending. Limitations of this study include a small sample size, two different surgical approaches, and inconsistent use of the VAS by patients to rate their pain level. Future nursing implications for this study would include providing effective pain control management, therefore enhancing patient's postoperative mobility and satisfaction with their pain management during hospitalization.

Engaging Students in Nuclear Physics Science Camp

Sarah Prill

Mentor: Drs. Catherine Mader, Paul DeYoung and Professor Tod Gugino Department of Physics

Getting students interested in the sciences is a difficult task that all teachers face. Hope College Summer Science Camps aim to do just this by providing interesting topics to engage students of all ages with the hope that they become excited about science and school in general. In order to enthuse high school students about Physics as a possible career option, a Nuclear Physics Science Camp is in the process of being created. This will allow high school students to learn the ins and outs of nuclear physics in a fun and creative way using hands on investigations. They will have the opportunity to use high-end research instruments as a part of their experience, including a particle accelerator and scanning electron microscope. They will also get to work on a lot of the equipment present at Hope including the particle accelerator and the scanning electron microscope. This camp will be implemented in the summer following the 2011-2012 school year.

This material is based on work supported by the Howard Hughes Medial Institute.

Composition of the ²⁴O ground-state wavefunction

Eric Traynor Mentor: Dr. Paul DeYoung Department of Physics

Unexpectedly, ²⁴O is a doubly magic nucleus. We would expect a nucleus to be stable with 8 or 20 neutrons but experimentally we find that 16 neutrons is more stable than 20 because at high neutron numbers the nuclear force becomes more complicated. To gain insight into the wavefunction of the ground state of ²⁴O, the cross sections for forming ²³O in the ground state and excited state during knockout reactions needs to be determined. ²³O is stable and is therefore relatively easy to count directly. However, ²³O* is unstable and decays too rapidly to detect directly (10⁻²⁰ s). ²³O* will decay to ²²O and a neutron. The neutron goes straight forward and is recorded by MoNA while the ²²O is deflected by a 4 T superconducting dipole magnet and is recorded by charged particle detectors. Using four-vectors of the ²²O and the neutron we can work backwards to the ²³O*. We will then be able to calculate the cross section of ²³O* and ²³O. Analysis of ²³O* is currently underway and analysis of the ground state will follow.

This material is based upon work supported by the National Science Foundation under NSF-MRI Grant No. PHY:0922794.

Differential PIXE Analysis of Layered Automobile Paint

Kiley Spirito

Mentors: Drs. Paul DeYoung and Graham Peaslee Department of Physics

Analysis of multi-layered samples is both time consuming and destructive; the layers must be mechanically separated and chemically dissolved, destroying the sample in the process. Particle Induced X-ray Emission (PIXE) uses a particle accelerator for non-destructive chemical composition analysis. Differential PIXE uses varying beam energies to penetrate different depths into the sample. In multi-layered samples, the different energies produce x-rays from only the layers which the beam passes through. A target element unique to each layer is used to tell the layer in which the beam stops at varying energies. Concentrations are obtained from the spectra using the peak fitting program GeoPIXE, which is particularly useful because it has multi-layered fitting capabilities. By adjusting the thickness of a layer until the target element concentrations are consistent across all energies, it is possible to approximate the thickness of that layer without taking it apart. With this method, at least two layer thicknesses in the five layer sample can be determined.

This material is based upon work supported by the National Science Foundation under grant No. PHY-0969058.

Spectroscopy of ¹³Li

Eric Lunderberg Mentor: Dr. Paul DeYoung Department of Physics

The spectroscopy of neutron-unbound levels in ¹³Li was examined. The ¹³Li were formed by a one-proton knockout reaction from a 53.6 MeV/u ¹⁴Be beam at the National Superconducting Cyclotron Laboratory. The decay energy spectrum was reconstructed from the four-momenta measured with the Modular Neutron Array (MoNA) and Sweeper superconducting dipole magnet experimental setup. Decays of ¹³Li, via two-neutron emission, were analyzed using Geant4 simulations. The results will be compared to Yu. Aksyutina *et al.*, Phys. Lett B **666** 430 (2008).

This material is based upon work supported by the Howard Hughes Medical Institute and the National Science Foundation under Grant No. PHY 0969058.

Exploring the effects of target composition on the decay of ¹³Be

Caitlin Taylor Mentor: Dr. Paul DeYoung Department of Physics

The study of unstable neutron rich nuclei involves understanding the ground state energy of a specific nucleus. The ground state energy of ¹³Be is known, but there has been evidence that the target used for neutron removal might cause the decay of ¹³Be to change. This experiment examines how the energy levels of ¹³Be change between using a carbon target and a deuterated polyethylene (CD₂) target. A 59.6 MeV/a ¹⁴Be beam is produced by the cyclotrons and A1900 fragment separator at the National Superconducting Cyclotron Laboratory at Michigan State University. In a target, one neutron is removed from the ¹⁴Be nucleus, producing an unstable ¹³Be nucleus. The ¹³Be nucleus immediately decays to ¹²Be and a neutron; the neutron is detected using the Modular Neutron Array (MoNA) and the charged particles are detected using a 4T superconducting sweeper magnet and a series of charged particle detectors. The decay of ¹³Be is reconstructed using the four-momentum of the emitted neutron and the fragment ¹²Be nucleus for each target. Result will be compared for each target by looking at the differences in decay.

This material is based upon work supported by the National Science Foundation under NSF-RUI Grant No. PHY:0969058 and the Michigan Space Grant Consortium.

Using the Maximum Likelihood Method to find the Optimal Parameters of the Models Describing the Pulsar Population Statistics

Caleb Billman Mentor: Dr. Peter Gonthier Department of Physics

We seek to maximize the likelihood of a set of parameters describing the distributions of the initial period, magnetic field, and radio luminosities in our pulsar population simulation code (Harding, Grenier, and Gonthier 2007) and in order to better understand the confidence region of the model. Our pulsar population code simulates pulsars at birth using Monte Carlo techniques and evolves them to the present assuming different models describing the birth distributions, spin down, and emission. One problem with this method is that it is difficult to explore the parameter space due to high computational time. Since we are dealing with comparisons of low counts, we need to describe the distributions using Poisson statistics, which is best accomplished within the maximum likelihood method (MLM). The popular least-squares method is an instance of the MLM that assumes Gaussian statistics, a valid assumption when the number of counts is high. In this scenario, we seek to maximize the likelihood using a Monte Carlo Markov Chain algorithm that randomly explores the parameter space by making jumps towards areas with higher likelihood. The observed pulsar characteristics that we will be trying to fit consist of the period, period derivative, the dispersion measure, and the radio flux. However, before the application to the main goal associated with the population study, a simple case study is presented as an illustration of the method.

This material is based upon work supported by Michigan Space Grant Consortium, Hope College Department of Physics Frissel Endowed fund, NASA Astrophysics Theory Program, and NASA - Fermi Guest Investigator Cycle 3.

Comparison of Local Nonlinearity in Patterned Superconducting Chips Composed of YBCO and TBCCO Materials with Vertical and Slanted Edge Structures

Sean Cratty

Mentor: Dr. Stephen Remillard Department of Physics

Two of the most commonly used materials for high temperature superconducting devices are $Tl_2Ba_2CaCu_2O_8$ (TBCCO) and $YBa_2Cu_3O_7$ (YBCO). Using a scanning electron microscope to look at manufactured superconducting chips composed of these materials, we are able to examine the edge structures of the patterned superconducting carriers and characterize them as either vertical walled (good manufacturing) or slanted walled (poor manufacturing). The superconducting materials exhibit nonlinear behavior at microwave frequencies as exhibited by second and third order intermodulation distortion (IMD). The IMD of YBCO and TBCCO samples with both slanted and bricked walls was compared along with the effects of hysteresis generated from an applied static magnetic field. At all temperatures the second order IMD in YBCO samples, in comparison to their TBCCO counterparts, display higher surface current densities at a constant drive current. The third order IMD of YBCO samples, on the other hand, are shown to be lower than those of TBCCO samples.

This material is based upon work supported by the National Science Foundation under NSF-REU Grant No. PHY/DMR-1004811, NSF-MRI Grant No. CHE-0959282, as well as support from Mesaplexx Pty LTD.

Resonant Compton Upscattering in High Field Pulsars and Magnetars

Matthew T. Eiles Mentor: Dr. Peter L. Gonthier Department of Physics

The extremely efficient process of resonant Compton scattering (RCS) in strong magnetic fields is believed to be a leading emission mechanism in high field pulsars and magnetars. New analytic developments for resonant Compton scattering, specifically spin-dependent cross sections devised using Sokolov & Ternov electron states, are the focus of this effort. These physically -correct forms display significant numerical departures from the older Johnson & Lippmann formalism for the cross sections in the resonance, thereby motivating the astrophysical deployment of this updated resonant Compton formulation. Useful approximate analytic forms for the cross section near and at the cyclotron resonance are presented. We highlight the application of these physics calculations in an inner magnetospheric model of the hard X-ray spectral tails in Anomalous X-ray Pulsars (AXPs), recently detected by RXTE and INTEGRAL. Relativistic electrons cool rapidly near the stellar surface, in the presence of intense baths of thermal X-ray photons, where the kinematics dominate and allow thermal photons to easily access the resonance. We present improved RCS electron cooling rates for magnetic fields above the quantum critical value, as functions of the magnetospheric colatitude and altitude. The kinematics provide the framework for an efficient scattering mechanism producing the characteristically flat spectral tails observed in AXPs.

This material is based upon work generously supported by the National Science Foundation under NSF-REU Grant No. PHY/DMR-1004811, and by Physics Department endowed funds (specifically the Guess Fund).

Effect of Carrier Doping on Nonlinear Distortion of Signals by Superconducting Films

Michael Bischak and Jinu Thomas Mentor: Dr. Stephen Remillard Department of Physics

High temperature superconductors are used in high frequency electronic devices. However, superconductor performance is limited by it's distortion of signals under the influence of electric current. Measurements of non-linear distortion made on $Tl_2Ba_2CaCu_2O_{8-x}$ (TBCCO-2212) wafers reveals dependence on carrier doping x, with grain boundaries contributing more significantly in under-doped films (x>0.1) as compared to those optimally doped (x=.1). The doping level was tuned by annealing the TBCCO-2212 thin films in a reducing nitrogen atmosphere at temperatures ranging from 250°C to 400°C. The microwave current dependent surface impedance of both pre- and post-annealed films was measured using a sapphire dielectric resonator. With the critical temperature being used as the indicator of carrier density, it was found that underdoped samples have larger nonlinear grain boundary losses as indicated by a weaker variation of surface reactance with surface resistance, revealing the preparation conditions for optimal wafer performance.

This material is based upon work supported by the National Science Foundation under NSF-REU Grant No. PHY/DMR-1004811.

Nickel, Iron, and Copper in Nanoporous Thin Films

Nathan Graber

Mentor: Dr. Jennifer Hampton Department of Physics

There has been success in using platinum to create nanoporous thin films that have interesting catalytic behavior. This project explores using less costly metals to create materials with similar properties. In this project two kinds of thin films were studied, NiFe and NiFeCu. The films were electrodeposited using controlled potential electrolysis (CPE). The copper was removed from the NiFeCu samples using CPE in an attempt to create a nanoporous structure within the thin film. The samples were characterized using a scanning electron microscope (SEM) with attached energy dispersive x-ray spectroscopy (EDS) software. The structure and composition of the films before and after copper removal was compared.

This material is based upon work supported by the National Science Foundation under NSF-RUI Grant No. DMR-1104725 and NSF-MRI Grant No. CHE-0959282

Development of a Low-Background Radiodating Facility at Hope College

Nick Hubley and Kelly Petrasky

Mentor: Drs. Paul DeYoung and Graham Peaslee Departments of Chemistry and Physics

Measurement of gamma-rays produced by various radioactive isotopes within sediment can be used to track the rate of sediment deposition or sediment transport through the watershed. In order to accurately measure the type and intensity of radioactive isotopes within sediment samples, a low-background gamma-ray counting facility is needed. This requires specialized detectors encased in multi-layer shielding (aluminum, copper and lead layers) to minimize natural background radiation. Hope College has developed such a facility with three high-purity Germanium detectors that are able to detect a wide range of environmental radioisotopes in soil samples with high precision and low background. The construction of this facility and preliminary measurements of the detector's efficiency, absolute solid angle and attenuation through soil samples will be presented for each detector. Examples of their use in environmental measurements of sediment fingerprinting in the Lake Macatawa watershed will also be shown.

Microwave Breakdown of Nitrogen Gas in a Microgap

TJ Klein

Mentor: Dr. Stephen Remillard Department of Physics

Dielectric breakdown of nitrogen gas in a *microgap* (specifically between 10 and 1000 microns) was found to be governed by different mechanisms than breakdown in large gaps. It is useful to characterize these mechanisms to identify regions of failure for MEMS (micro-electro-mechanical systems) devices. Pressure dependence of the breakdown electric field revealed a *collisional pressure regime*, which contains particles having frequent low-energy collisions resulting from the short mean free path of a high pressure gas, and *collisionless pressure regime*, which contains particles having infrequent high-energy collisions resulting from the long mean free path of a low pressure gas. As gap size was reduced, the collision frequency coefficient was found to depend exponentially on the pressure exponent. At large gaps (greater than 2540 microns) and at small gaps (less than 75 microns), the collision frequency coefficient and the pressure exponent level off, as gap size is varied, showing us that there are different limiting factors to the diffusion length of the plasma. Optical emissions reveal that different molecular excitations dominate the plasma at small and large gaps.

Our material is based on work supported by the National Science Foundation through NSF-REU grant No. PHY/DMR-1004811.

Characterization of Electrodeposited Nanoporous Materials

Kyla R. Koboski Mentor: Dr. Jennifer Hampton Department of Physics

The characterization of nanoporous thin film depositions is done by various analytical processes. These procedures are used to both create and analyze various electrodeposited thin films by measuring capacitance, electrode area, roughness factors and catalytic behavior. The depositions are crafted by using Controlled Potential Electrolysis. In this procedure, the potential at which the metal alloy is deposited is set and either the length of time for the deposition or the total charge of the deposition can be adjusted. Another technique used to analyze the roughness of the depositions is Cyclic Voltammetry. Cyclic Voltammetry uses a controlled working electrode potential at various scan rates and measures the current values. DC Potential Amperometry is a process used to analyze the reactivity of the depositions. When this process is used, a constant potential is applied to the working electrode; the corresponding current due to the desired reaction is measured. These processes were implemented for nickel thin films as a model system to validate their utility.

This material is based upon work supported by the National Science Foundation under NSF-REU Grant No. PHY/DMR-1104811, NSF-RUI Grant No. DMR-1104725 and NSF-MRI Grant No. CHE-0959282.

Quantitative Analysis of Various Metalloprotein Compositional Stoichiometries with Simultaneous PIXE and NRA

Andrew McCubbin

Mentors: Drs. Paul DeYoung and Graham Peaslee Departments of Physics and Chemistry

Stoichiometric characterization has been carried out on multiple metalloproteins using a combination of Ion Beam Analysis methods and a newly modified preparation technique. Particle Induced X-ray emission (PIXE) spectroscopy is a non-destructive ion beam analysis technique well suited to determine the concentrations of heavy elements. Nuclear Reaction Analysis (NRA) is a similar technique which measures the areal density of a thin target by quantifying scattering cross sections of 3.4 MeV protons. A combination of NRA and PIXE has been developed to provide a quantitative technique for the determination of stoichiometric metal ion ratios in metalloproteins. About one third of all proteins are metalloproteins, and most do not have well determined stoichiometric compositions for the metals they contain. Current work focuses on establishing a standard method in which to prepare protein samples. A modified method of preparation is currently being investigated. The method involves placing drops of protein solutions on aluminized polyethylene terephthalate (Mylar®) and allowing them to dry. This technique has been tested for several proteins to determine cofactor content and has proven to be a reliable analysis method, accurately determining metal stoichiometry in these proteins.

This material is based upon work supported by the Hope College Dean for the Division of Natural and Applied Sciences and by the National Science Foundation under NSF-RUI Grant No.PHY- 0969058.

SOCIAL SCIENCES COMMUNICATIONS

International Perceptions of Impact of Global Communication

Jasmine Harris and Brittni Nowicki Mentor: Dr. Deidre Johnston

The hypothesis of this study is that high levels of global exposure (measured by international internet, media, and travel experience) in college-age students will be related to positive beliefs regarding global communication (the intercultural diffusion of ideas and values). Internet survey data was collected from college-age students from China, Korea, Mexico, Japan and the United States. Surveys were conducted in the language of the countries surveyed and administered by local college faculty in each country. A twenty-one item global exposure scale indicates that global exposure varies significantly by country with Korea featuring the highest level of global exposure followed by the United States, Japan, Mexico, and China respectively. Factor analysis revealed four dimensions of global perceptions: National Progress (belief that global communication leads to government accountability, effects global politics, promotes scientific and technological development), Cooperation (belief that global communication promotes peace and solutions to world problems), Fear (belief that global communication threatens the traditions and morals of one's culture), and Pro-West (belief that global communication promotes democratic values). The beliefs of Mexican college students were consistent with the hypothesis of the study in that comparatively lower levels of global exposure was associated with high fear of global communication, and cynicism that global communication might promote national or world progress. However, inconsistent with the hypothesized relationship, Koreans who had the highest level of global exposure also had the highest Fear scores of the nations surveyed. Further, mean scores for Pro-West beliefs were highest for China despite low global exposure scores overall. These preliminary results reveal a more complex relationship between global exposure and the four identified dimensions of global perception than originally hypothesized. Further analysis of international data from Japan will be incorporated in the study Spring 2012, and implications of results will be explored.

The Halo Effect's Influence on Mate Selection

Emily Evans

Mentor: Drs. John Lunn and Enrico Manlapig Department of Economics, Management and Accounting

This research seeks to expand on the findings of Fisman, Iyengar, Kamenica, and Simonson (2006). In a Speed Dating Experiment Fisman et al. (2006) concluded that men do not find women desirable if a woman is perceived as having a higher level of intelligence or ambition than their own. Their conclusion is in line with the social structure theory. However, this research found through the introduction of an interaction variable to the model used by Fisman et al. (2006) that a Halo Effect is present among certain attributes considered during the mate selection process. It can be concluded from this research that a woman's attractiveness is enhanced by her intelligence and sense of humor, while a man's attractiveness is enhanced by his sense of humor.

The National Hockey League and Salary Determination: Are NHL Player's Salaries Discriminated Against Based on Country of Origin?

Chris Kunnen

Mentor: Dr. Todd Steen Department of Economics, Management and Accounting

Since the earliest research was conducted on professional sports leagues and their respective labor demands and supply factors, much emphasis has been given to the study of discrimination and its effect on equilibrium salaries. Within the NHL in particular, since the publication of player earnings beginning in 1990, much research has been conducted regarding discrimination based on country of origin and whether it is a factor and, if so, where is it being sourced? But while the only discrimination that has been found regards French-Canadian defensemen, little research has been conducted since the NHL lockout in 2004-2005 to provide further evidence to support this claim or whether this notion of bias should be rejected. Yet upon utilizing regression analysis within a new model with variables utilized in previous research, coupled with new data post lockout period, I have found evidence that continues to support the notion of discrimination within the National Hockey League but with a different group of players. With the addition of more explanatory variables coupled with various testing of the sources of such discrimination, this research lays the foundation for a plethora of opportunity for additional research and explanation within the parameters of NHL discrimination and salary determination.

Categorizing Children's Books Used in the CASA Program by Reading Levels and Life Skill Themes

Kristen Craig Mentor: Dr. Laura Pardo Department of Education

This project was an extension of a previous one that researched the effectiveness of CASA on elementary student's academic achievement. CASA is an after school tutoring program for at risk elementary students in the Holland area. Tutors are Hope College students who volunteer their time and come from a variety of majors. The results of the first study showed that one of CASA's strengths was in the relationships developed between the tutors and the K-5 students. To build on this strength, the CASA program administrators decided to design and implement a Life Skills component to the CASA program. Each tutoring session would include 20-30 minutes of activities focused on one of the life themes (examples include cooperation, respect, goal setting, cultural diversity, friendship, and problem solving). During the summer, the current project occurred and involved cataloging and categorizing over 1800 children's books used in the tutoring program. The books were first entered into a data base and then readability was determined for each book. Books were then categorized into CASA's life skills themes. Findings revealed that some themes need more books, and that many books are subject matter based (i.e. The Magic School Bus series which focus on science concepts) and do not fit easily into the life skills themes. CASA has implemented the life skills component during the fall 2011 semester, and data from this work will be analyzed and available prior to the celebration.

This research was supported by the Carl Frost Center for Social Science Research.

What Makes Successful Independent Living for Individuals with Disabilities?

Sarah Lidgard and Jayne Vroon

Mentor: Dr. Jane Finn Departments of Education/Special Education

The Friendship House is a living establishment located at a seminary campus which students without disabilities live along side people with cognitive impairments. An assessment instrument for indentifying and planning for the comprehensive needs for individuals with disabilities called the Transition Planning Inventory (TPI) was given to (a) roommates without disabilities (b) roommates with cognitive impairments, and (c) parents of the roommates with cognitive impairments. Descriptive statistics were calculated in the areas of employment, further education/training, daily living, leisure activities, community participation, health, self determination, communication, and interpersonal relationships. Also, Pearson correlations coefficient assessed the degree that the quantitative variables are linearly related. The results gleaned from this research will help determine and identify critical transition planning areas for the roommates with disabilities.

EDUCATION

The Effects of Project-based Learning (PBL) Approach on the Achievement and Efficacy of High School Mathematics: A Longitudinal Study Investigating the Effects of the PBL Approach in Math Education

Anna Filcik, Kristen Bosch, Nicholas Haugen and Samuel Pederson

Drs. Vicki-Lynn Holmes and Yooyeun Hwang, Mentors Department of Mathematics and Department of Education

Project-Based Learning (PBL) is a teaching method that is significantly different from the conventional classroom teaching; however, the positive effects of PBL have not been clearly established. This longitudinal study investigates the effect of Project Based Learning on Secondary mathematics' students in order to determine both academic skill development and motivational factors that affect learning. Motivational factors to be measured include self-regulation, self-efficacy, and learning strategies. Unlike previous studies conducted in conventional school environs, this study will be conducted on a dedicated project-based high school, where PBL is not being used as additional or supplemental teaching, but as a whole curriculum. Our study will provide the space for teachers to reflect on the effectiveness of the implementation of this pedagogical approach to mathematics teaching and learning.

Because our study's participants represent a wide range of mathematical abilities and demographic diversity, it may bring clarity on controversial issues regarding the benefits of PBL on certain populations. Specifically, PBL has been shown to work well with students who already have a deep conceptual knowledge of the subject matter, but it may be less effective with those possessing only surface knowledge (Vernon and Blake, 1993; Dochy, Segers, van den Bossche, & Gijbels, 2003). In addition, the benefits of PBL on low SES students are debated (Boaler, 2002; Delpit, 1988, Lubienski, 2000). Even though research shows that elementary mathematics students benefit from PBL, very little evidence is associated with secondary success (Petrosino, 2004; Strobel and Van Barneveld, 2009; Walker and Leary, 2009). Hence, this study provides a unique opportunity for teachers to understand the additional dimension of PBL approach on this varied population.

This study follows 8th and 9th graders through high school graduation, thus providing teachers with a solid picture of the developmental process of learning secondary mathematics through PBL.

This research was supported by The Carl Frost Center for Social Science Research and Howard Hughes Medical Institute.

Counting Cailloux, Multiplying Mambos: An Analysis of Mathematics Education in Cameroonian Primary Schools

Rachel Elzinga

Mentors: Christiane Magnido, School for International Training

This research is the result of a four-week study of mathematics education in Cameroonian primary schools. In order to fully understand the topic, the research investigated mathematics curriculum, methods of instruction, the system for teacher preparation, and an evaluation of the community's perception of mathematics education. Data collection integrated participant observations in two francophone primary schools in Dschang, interviews with primary school teachers, interviews with ministry of education officials, and survey data from teachers and community members in Yaoundé, Ngaoundéré and Dschang. Overall, three conclusions were drawn from the data collected. First, that mathematics is perceived as important by the community and the same sentiment exists within the school environment. Second, that primary level mathematics content and pedagogy is almost identical between public and private schools; the more important factor in the quality of instruction is the individual teacher. Finally, although the idea of in-service training is praised, actual opportunities for teacher education specifically in math are limited.

This research was supported by SIT Study Abroad.

Barefoot Training and its Effects on Balance, Proprioception, and Stability in Adults 65 and Older

Emilee Anderson and Emery Max Mentor: Professor Stein Slette Department of Kinesiology

Proprioception is one's awareness of their body and limbs in relation to their surroundings. Balance and proprioception are key components of not only athleticism, but everyday function and injury prevention in the general population. With age, there is a marked decline in lower extremity strength, balance, and proprioception. Linked to this is an increased fall risk in the elderly population. Research has found that impaired stability (a combination of proprioception and balance) is one of the most prevalent causes of falls. Research has also found, however, that stability focused exercise interventions are effective in improving balance and proprioception, therefore reducing fall related injuries. Recently, barefoot training has increased in popularity. There is limited research available on the topic of barefoot running and virtually no research that looks at how proprioception and balance are affected by barefoot training. The present study was designed to determine if barefoot training is more effective than shod training at improving balance, proprioception, and stability in active, senior adults. Participants were assigned to one of three groups: barefoot training, shod training, or control. The barefoot training and shod training groups participated in 7 weeks of twice-weekly training which focused on balance and stability, as well as lower extremity and core strengthening. At the beginning and end of the 7-week period, all participants underwent balance testing using an AMTI AccuSway Balance Platform. This data will be used to determine whether shod or unshod training is more effective at improving balance Platform.

Effects of High Intensity Interval Training vs. High Volume Training on VO2max, Power, and Body Composition of College-Age Students

Paul Bowen, Logan Neil, Amanda Norton, Kylie Padgett

Mentor: Dr. Kevin J. Cole Department of Kinesiology

The purpose of this study was to examine the effectiveness of a high intensity interval-training program compared to a more traditional endurance-training program. A sample of seventeen college-aged students (11 males, 6 females) ranging in ages from 18-20, were randomly assigned to either a high intensity interval training (HIIT) group (n=9) or a high volume training group (n=8). Pre- and post-training measurements of cardiovascular endurance (VO₂max), body composition, resting heart rate, resting blood pressure, vertical jump, and anaerobic capacity (Wingate test) were used to evaluate each participant's fitness level. The HIIT group exercised on stationary bicycles for a total time of 12-14 minutes per training session. This was followed by 6-8 sets of 30-second, 100% effort, sprint intervals, with resistance, ending with 1 minute of active recovery with no resistance. The participants in the HVT group exercised by riding a stationary bicycle at 75% of their max heart rate for 30 minutes. Both groups trained 3 times per week for four weeks, for a total of 12 exercise sessions. Following 4 weeks of training, no significant differences between the two training regimens were found. However, a significant difference was found within the pre- and post-tests for each group. Significant results were seen for VO2max (p<0.024, 1.020±.396), systolic blood pressure (SiBP) (p<.024, 117.451 ±1.105), diastolic blood pressure (DiBP) (p<0.009, 75.017±1.028), resting blood pressure, perceived exertion (RPE) (p<0.00, 1.982±.179), absolute mean power (AMP) (p=0.036, 455.417±34.730) and relative mean power (RMP) (p=0.032, $6.314 \sim \pm .375$). Based on this study, minimal evidence exists to support the hypothesis that greater anaerobic and aerobic improvements will occur from high intensity interval training compared to traditional endurance training (high volume training) over a four-week period of time.

Rupture of the Ulnar Collateral Ligament

Allison Isham Mentor: Dr. Kirk Brumels Department of Kinesiology

Injuries to the elbow are a frequent occurrence in sports that can range from being a mild inconvenience to an injury that severely limits participation. This case study examines an acute rupture of the ulnar collateral ligament of the elbow. Injuries to this ligament are relatively common with repetitive motion sports, such as throwing or racquet sports, but usually present as a chronic of overuse type of injury. Acute ruptures are a more unusual occurrence. Signs and symptoms associated with these injuries are significant pain on the medial aspect of the elbow that intensifies with motion and instability of the elbow joint. Management options for this type of injury are dependent on clinical exam and expected/ desired activity levels of the patient. Both surgical and conservative treatment options will be outlined in this case study.

The Effects of Creatine Supplementation on a 4-Week Linear Periodization Resistance Training Program Among Hope College Students

Dan Kraakevik and Zak Vossen Mentor: Dr. Kevin J. Cole Department of Kinesiology

Creatine supplementation has been shown to improve muscular strength and performance due to an increased rate of phosphocreatine resynthesis. This study examined the effectiveness of creatine supplementation (CRE, n=5) during a 4-week training regimen of 4 days of lifting on anaerobic power, muscular strength, and lean body mass compared to a placebo group (PLA, n=6). There were no effects seen between groups with creatine consumption, but both groups showed an increase in strength over time for bench press, squats, tricep extensions, bicep curls, leg curls, lat pulldowns and knee extensions. There was a trend for improvement with creatine on vertical jump (CRE PRE: 25.5 in. +/- 0.75 POST: 26.8 +/- 1.01 PLA PRE: 24.3 in +/- 1.42 POST: 24.4 in. +/- 1.46 p= 0.109). There was a trend for less of a decrease in mean power over two trials of Wingate testing with CRE compared to PLA (CRE trial 1: 667.875 Watts +/- 19.514, CRE trial 2 606.375 Watts +/- 19.912, PLA trial 1: 578.083 Watts +/- 13.01, PLA trial 2: 470.75 watts +/- 13.299, p=0.1). There was no difference between groups regarding body composition or weight. From this study, it can be concluded that creatine does not have a significant effect on increasing strength and anaerobic power over the course of a 4-week training program.

Ulnotriquetral Ligament Split Tear in a Collegiate Tennis Player

Zach Riepma

Mentors: Dr. Kirk Brumels, and Professors Margaret Frens and Brian Dykhuizen Department of Kinesiology

An ulnotriquetral (UT) ligament split tear is a unique injury that involves the ulnotriquetral ligament in the wrist. The UT ligament attaches at the ulna and triquetrium bones which are located on the medial aspect of the wrist. UT split tears are a unique injury that has the potential to be very frustrating, painful and difficult to diagnose, and because of this, it is paramount that the proper attention to detail be taken during the initial examination and recognition of the differential diagnosis possibilities. The mechanism for this injury is usually blunt force, whether from a fall or being struck by an object causing the delicate ligament to split. This is in contrast to the presentation of many other ligament tears which are characterized by rupture or avulsion of the ligament from the bone causing clinical joint instability which can be noted by the clinician and assists in the diagnosis of a ligament injury. This case will detail the diagnostic difficulties often associated with these injuries and outline various aspects of UT ligament injury management providing clinicians with tools to assist in recognition of the UT split tear especially when there is pain in this area without joint instability.

DVD-Based High Intensity Interval Exercise vs. Moderate Continuous Exercise: Which Type is More Beneficial to Overall Fitness?

Kristine Baldwin, Salome Emmanuel, Zachariah Jones, Brittany Schimmel Mentor: Dr. Maureen Dunn Department of Kinesiology

High intensity interval training (HIIT) has previously been shown to increase physical fitness to a greater extent than continuous moderate intensity exercise performed for the same or greater duration. However, most studies of HIIT have utilized stationary bicycles for training. This study examined HIIT using the DVD-based program "Insanity". Participants volunteered to be in either the Insanity group (n=9) or a control group (n=7). The Insanity group completed the DVD exercise for 30 minutes, 3 times/week, while the control group completed 30 minutes of continuous moderate intensity cardiovascular activity 2 times per week along with 30 minutes of strength training 1 time per week. VO2 max, body fat percentage, vertical jump, timed push-ups and sit ups were assessed prior to and following 5.5 weeks of training. Following training there were no differences between the groups for VO2 max, body composition or sit ups. There was a trend for improved vertical jumps in both groups (Insanity pre: 22.17±1.17, post: 23.2±1.3 inches; Control pre: 17.5±1.33, post: 17.64±1.46 inches. p=0.08). There was also a significant improvement in both groups for the push-up test (Insanity pre: 44.67±15.54, post: 58.22±17.28; Control pre: 31.0±14.8, post: 37.71±12.24. p=0.000) with the Insanity group showing a greater increase in response to training compared to the control group (p=0.05). Although there were not many differences between groups, positive trends in the results suggest it is possible that a longer duration of study may yield more significant results.

Effects of Creatine on Sprint Time and Body Composition of Division III Baseball Players

Dane Roach, Colton Bodrie, Jesse Fazi, and Chris Harwood

Mentor: Drs. Maureen Dunn and Kevin Cole Department of Kinesiology

Taking creatine as an ergogenic aid may help to increase performance in anaerobic activities such as sprinting. Theoretically, creatine supplementation improves performance by increasing the amount of creatine phosphate allowing more fuel for ATP production which enables the body to produce more energy at a higher rate. This study was designed to determine if taking creatine as a supplement(CRE, n=4) when coupled with a six week speed training regimen performed 3 times per week would result in a greater decrease in 60 yard dash time when compared with only performing the 6 week speed training regimen(CON, n=4). It was hypothesized that over the six week training period the creatine group would improve on their sixty yard sprint times while increasing their lean body mass. Following the six week training period, body mass in the creatine group increased significantly (M= 2.97kg, +/- .94kkg, p= .008). No significant difference was found in the control group. Body composition for the creatine group significantly increased (M=2.55%, +/- 1.51%, p=.044) while no significant difference was seen in the control group. There were no significant differences between 60 yard sprint times in the creatine group or the control group. According to our study, there was no evidence that creatine increased lean body mass or improved performance in the 60 yard dash.

This research was supported by the Kinesiology Department.

KINESIOLOGY

Examination of the Onset, Rehabilitation and Biomechanics of Cuboid Syndrome in Collegiate Female Basketball Players

Kurt Otto Buchholz

Mentor: Dr. Kirk Brumels Department of Kinesiology

Cuboid syndrome has many different forms of onset, as it can stand alone as a pathology or be coupled with another injury. This variability in onset makes it crucial to understand when dealing with many forms of foot and ankle rehabilitation. Because of the position in the foot, many different forces act upon the cuboid and the surrounding structures, making an understanding of the necessary biomechanics crucial to effectively rehabilitating, and further preventing reinjury to, this area of the foot. This case study investigates the various aspects of two different injuries, both involving cuboid syndrome. This case study examines the onset, treatment, and overall biomechanics that lead to the development of the syndrome, as well as the associated rehabilitation.

Does Drinking Chocolate Milk at Half-time Lead to Better Second Half Performance than Gatorade?

Sarah Antrobus, Liisa Mosher, Megan Sliva and Kristina Bectel

Mentor: Dr. Maureen Dunn Department of Kinesiology

The purpose of this study was to determine if Nesquik Chocolate Milk or Glacier Freeze Gatorade, given in equal amounts of carbohydrates, would allow for maintenance or decreased performance time in a second bout of an obstacle course. This would simulate an athletic event with the recovery drink being consumed during a twenty minute half-time break. Seven healthy college-aged women completed an obstacle course containing 10 high intensity exercises that took a total of 10-15 minutes to complete. Completion time of the course was compared between a pre and post run to measure performance along with blood glucose and lactate levels. It was hypothesized that there would be no difference in the performance times when comparing chocolate milk and Gatorade, but both drinks would improve performance following ingestion at half-time. Results indicated that there was no statistical difference in performance times following ingestion of Gatorade or chocolate milk, but that both groups performed more quickly in the 2nd bout. The participants who consumed chocolate milk ran an average of 52.7 seconds faster during the second obstacle course run and the participants who drank Gatorade ran an average of 22.8 seconds faster. No adverse events were recorded following ingestion of either beverage. These findings suggest that both chocolate milk and Gatorade can be effective recovery drinks during a short half-time break.

Herpes Zoster Outbreak in a 20-year-old, Collegiate Volleyball Player: A Case Study

Emilee Anderson

Mentor: Dr. Kirk Brumels Department of Kinesiology

Herpes Zoster, more commonly known as Shingles, is caused by the Chicken Pox (varicella zoster) virus. After an outbreak of the Chicken Pox, the virus remains in the body, lying dormant in the spinal cord. For reasons that are somewhat unknown, the virus can reactivate and travel along nerves, presenting as a red, blistering rash, often accompanied by pain and feelings of malaise. While Herpes Zoster typically presents on the torso, in the case studied it spreads along the upper extremity. In addition, it is most common in adults over age 60, however as evidenced by the present case, can affect all ages. This study looks at a unique case of shingles in a collegiate volleyball player and addresses the treatment which allowed the athlete to remain physically active through the duration of the virus. While the case has no definitive conclusions, it does offer insight into an uncommon condition among collegiate athletes and emphasizes the importance of a holistic approach to healthcare.

Muscular Activity during a Fly Fishing Cast: Evaluation and Comparison According to Casting Ability and Fly Rod Type

Kurt Otto Buchholz and Katherine J. Voorhorst

Mentors: Drs. Kirk A. Brumels and Kevin J. Cole Department of Kinesiology

Prior research, although limited, suggests that the most common fly-fishing injuries occur due to muscular imbalance and overuse caused by biomechanical abnormalities and differences in casting style. Through our research, we investigated the muscle activity of the upper-extremity skeletal muscle during a fly fishing cast. Using surface electromyography (sEMG) we sought to determine the extent of muscular activity during the casting motion. We examined the musculature of the shoulder, rotator cuff, and wrist flexors and extensors. Participants were recruited through a convenience sample, consisting primarily of acquaintances, recommendations and volunteers. This method ensured that there was an adequate representation of both levels of casters with prior knowledge of fly-fishing. We compared across skill levels (novice and advanced) as well as a comparison of rod composition (graphite and bamboo). Also, we used a casting analyzer, developed by the fly fishing company Sage Manufacturing, to record biomechanical data regarding the size of the cast arc, casting symmetry, and smoothness ratio, among other variables. We compared these statistics among participants within their relative skill groups, as well as across rod composition type. This research bettered the understanding of the muscular activity involved in the fly fishing cast. This information will be used to develop fly-casting injury prevention programs, similar to those involved with other recreational activities such as tennis, golf, and skiing.

This research was funded by Carl Frost Research Center

"I Think I Have Shin Splints!" Lower Leg Pathologies in Athletics

Amanda Engbers Mentor: Dr. Kirk Brumels Department of Kinesiology

In the medical field, some illnesses or injuries may go undiagnosed due to an improper use of medical terminology. In athletics, using terms such as "getting my bell rung" can seriously downplay the severity of a concussion; just as saying "it's just shin splints" can mask more serious issues in the lower leg. When these injuries go undiagnosed or considerably downplayed, the athlete may suffer further injury and other complications. This study looks at one particular case in a collegiate runner who experienced lower leg pain which went diagnosed as "shin splints" until the real reason was found: a stress fracture. Three years of multiple doctors visits and unresolved pain were the result of this original misdiagnosis. This case emphasizes the importance of knowing your anatomy, as well as the signs and symptoms of injuries. This knowledge will help ensure patients the best care by being able to recognize pathologies and possible differential diagnoses that may confound these situations.

Morphea & Other Non-communicable Skin Conditions

Valerie Headley

Mentor: Dr. Kirk Brumels and Professor Margaret Frens Department of Kinesiology

This case study examines a relatively uncommon skin condition entitled morphea that affected the athletic participation of a female collegiate basketball player. The case study will focus on providing information, improving understanding, and detailing identification, diagnostic, and treatment procedures for morphea. In addition, management strategies such as superficial ultrasound, moist hot packs, and myofascial techniques (such as myofascial release, massage, and Graston technique) will be discussed. The condition of morphea will be compared to other non-communicable skin conditions that may also affect athletic participation.

Balance Rehabilitation in Multiple Sclerosis: A Comparison of Conventional Training with Nintendo[®] Wii Fit™ Game Play

Kirstin Robinson, Lauren Gaines, and Christopher Schmelz

Mentors: Drs L. Maureen Dunn and Kirk A. Brumels Department of Kinesiology

Balance and gait disturbances are commonly observed, but poorly managed, in individuals with multiple sclerosis (MS). This pilot study compared the effects of Nintendo® Wii Fit™ game play (WII), conventional balance training (TRAD), and control (CON) on balance and mobility outcomes among home-dwelling persons with MS. Nineteen female and 6 male MS patients (mean age: 45.3±8.8 years) with self-reported balance deficits underwent clinical assessment using the Berg Balance Scale (BBS) before (0 weeks, PRE) and after 3 weeks of supervised balance training sessions (MID) and again after 9 weeks of at-home training (POST). Participants further completed questionnaires regarding balance confidence (ABC), walking ability (MSWS-12) and fatigue (MFIS). All training was 3 sessions per week for 30 minutes per session. Compliance varied substantially between individuals for at-home training, but was 100% for supervised training. Effect sizes from PRE to MID and PRE to POST testing were calculated for each group and outcome measure to demonstrate magnitude of change. Following supervised training, both training protocols had greater effects on BBS scores than CON (d'=-0.43), with TRAD (d'=0.84) having a larger effect than WII (d'=0.60). These effects remained following at-home training. PRE to POST effect sizes for BBS scores were as follows: CON, d'= 0.08; TRAD, d'=1.08; WII, d'= 0.75. Questionnaires showed similar trends with effect sizes from PRE to POST for ABC (d'=0.15, 1.02 and 0.34), MSWS-12 (d'=-0.34, 0.35 and 0.27) and MFIS (d'=-0.34, 0.35 and 0.37) and 0.37) and 0.37 0.92, 0.45 and -0.04) for CON, TRAD and WII, respectively. Results suggest that balance rehabilitation training using WII and TRAD may both be effective in improving balance, confidence, perceived walking ability, and fatigue when compared to CON, with TRAD being potentially more effective than WII for this subset of individuals with MS.

This investigation was supported by a grant from the National Multiple Sclerosis Society.

Effects of Caffeine Ingestion on Cognitive Performance after Maximal Anaerobic Activity

Ryan Holmes, Ryan Richter, Cory Gowman and Garrett Stier

Mentor: Dr. Maureen Dunn Department of Kinesiology

Caffeine may serve as a stimulus to improve psychomotor ability following high intensity exercise. The study was designed to determine whether a 5mg/kg caffeine supplement would provide any improvement in cognitive ability following the Wingate Anaerobic Test (WaNT) and any increase in peak and mean power during the WaNT. Hope College students (n=15), ages 18-22 performed two randomized, double-blind WaNT trials, one with caffeine and one with a placebo, one week apart. Cognitive ability was evaluated following the WaNT by measuring reaction times during Stroop and Simon tests on a computer. It was hypothesized that caffeine would not significantly increase peak and mean power, but that it would increase cognitive ability following the WaNT. Caffeine had no effect on peak power, mean power or cognitive ability. There was a difference in mean power output (p=.007) between the two trials, but the difference was attributed to time of testing. Mean power during the first trial (625.5 + /- 40.3 watts) was greater than mean power during the second trial (593.8 + /- 39.2 watts). A difference in cognitive ability (p=.003) during the Stroop test, when the font name differed from the font color, was noted as well. This difference was also attributed to the time of testing. Mean reaction time during the first trial of the Stroop test (820.1 + /- 49.2 milliseconds) was slower than reaction time during the second trial (718.9 + /- 44.1 milliseconds). Although caffeine did not affect power or cognitive ability following maximal anaerobic exercise in this pilot study, minimal evidence from other studies exists to draw definitive conclusions.

KINESIOLOGY

Surgical, Structural, and lifestyle Considerations Following Multiple Knee Surgeries

Lauren Welsch

Mentor: Dr. Kirk Brumels, Professors Tonia Gruppen, Margaret Frens and Brian Dykhuizen Department of Kinesiology

This case study examines a female college student and her struggles with multiple knee surgeries, including three Anterior Cruciate Ligament (ACL) reconstructions, a meniscal repair, and an Autologous Chondrocyte Implantation (ACI). The purpose of the case study is to better understand the consequences of multiple ACL reconstructions on the structural integrity and effects on the function. This case study will also discuss the ACI procedure in an attempt to increase the function and decrease pain, and degenerative processes. A general bony and ligamentus anatomy will be included along with the general procedure of ACL reconstruction. The different options for donor tissue in an ACL reconstruction will be outlined and discussed. To conclude, the case study examine the factors that might predispose someone to multiple ACL or meniscal injuries.

ACL Reconstruction and Posterolateral Corner Repair of the Knee

Sarah Wilhelm

Mentors: Dr Kirk Brumels; Professors Margaret Frens, Tonia Gruppen and Brian Dykhuizen Department of Kinesiology

This case focuses on a Division III soccer player who suffered an injury to his left knee during the beginning of the Fall 2011 season. After meeting with different orthopedic surgeons it was determined that there were several structures that were torn or needed repair. The structures included were the anterior cruciate ligament, a commonly injured structure of the knee, as well as the lateral collateral ligament, the posterolateral capsule of the knee, and the bicep femoris tendon. The latter structures are not commonly injured and are what makes this case very unique. The athlete underwent a surgery to reconstruct the ACL and repair the remaining structures. Rehabilitation is currently underway and is progressing well. This presentation will include the relevant anatomy, mechanism of injury, surgical intervention, and rehabilitation that was completed.

Jones Fractures and Associated Fractures of the Fifth Metatarsal

Kirstin Robinson

Mentors: Dr. Kirk Brumels, Professors Margaret Frens, Tonia Gruppen, and Brian Dykhuizen Department of Kinesiology

Fractures of the fifth metatarsal are one of the more commonly seen foot fractures amongst athletes, especially at the beginning of a season. They were first noted in 1902 by Sir Robert Jones and were then classified into four different types based on location of the fracture and mechanism of injury. The most common of the fifth metatarsal fractures is a Jones fracture. The other fractures of the fifth metatarsal are avulsion fractures of the tuberosity of the fifth metatarsal, shaft fractures, and stress fractures. What makes the Jones Fracture unique is that it occurs within 1.5 centimeters of the styloid process of the fifth metatarsal and typically requires at least six weeks of non-weight bearing unless the athlete undergoes surgery, in which case it may be shortened to four weeks. Careful observation must occur with a Jones fracture because they can be problematic to athletes, due to the high rate of non-union, avascular necrosis, and re-fractures because of the lack of vascular structures in the area. These complications may require open reduction internal fixation surgery and create physical activity limitations requiring careful rehabilitation. Despite all of the complications that may arise from fractures of the fifth metatarsals with proper treatment and rehabilitation the athletes will have the opportunity to return to play.

Staying Strong: Masculine Attitudes, Drive for Muscles, and Preference for Submissive Mates in Men and Women

Evan Beals and Julia Roehling Mentor: Dr. Mary Inman Department of Psychology

We tested for positive relationships between masculine attitudes, drive for muscles, and romantic preferences in 353 undergraduates. Men's masculine attitudes were positively related to drive for muscles, sexist attitudes, and submissive mate preference. Women's masculine attitudes were positively related to drive for muscles and repulsion of dominant mates. We also examined the benevolent sexism in men and women and found that benevolent sexism was positively related with attraction to a submissive mate in men and to a dominate mate in women.

Attachment and Hikikomori: a Psychosocial Developmental Model

Alexander Krieg

Mentor: Dr. Jane R. Dickie Department of Psychology

Hikikomori is the Japanese term that describes the condition of acute social withdrawal, and represents a terrible loss both on a personal and societal level. The purpose of our study was to investigate some of the risk factors that predict *hikikomori*, and to condense it into a psychosocial developmental model, which may help explain the etiology of this condition. In this poster presentation, we summarize the research on attachment theory, parental rejection and temperamental characteristics. We discuss the transfer of attachment style from parents to peers, and examine existing literature relating attachment and withdrawal behaviors in the West, and make connections with the case studies and clinical observations of *hikikomori* in Japan.

We compared a clinical sample of Japanese *hikikomori* (N=24) with an age match contrast group of undergraduate students (N=61) on measures of maternal attachment, dispositional shyness, parental rejection, and peer rejection.

Supporting our predictions, the *hikikomori* sample scored significantly higher on the Maternal Attachment Scale's measure of Ambivalence. They also scored higher on parental rejection, dispositional shyness, and peer rejection. Finally, we performed a path analysis to test our psychosocial developmental model. This revealed that while parental rejection did significantly predict ambivalent attachment and peer rejection, it did not directly predict *hikikomori*. As the model predicted, it is the combination of ambivalent attachment and peer rejection that together significantly predict *hikikomori*. Trait Shyness showed a trend in impacting ambivalent attachment, but did not predict *hikikomori*.

As one of the first empirical studies on *hikikomori*, we conclude with the model's important implications for both prevention and intervention that could pave a way towards recovery.

Reaction Time Differences in Identification of Speaker Gender and Ethnicity

Jacqueline M. Canonaco, Ryan M. Tussey and Chelsea E. Lynch

Mentor: Dr. Sonja Trent-Brown

Department of Psychology

The purpose of this study was to examine reaction times of listeners making perceptual identifications of speaker ethnicity and gender. Listeners heard stimuli produced by 20 African American and European American adult male and female speakers. The stimuli were presented with respect to phonetic complexity (sentences and words) and temporal condition (forward and reversed), producing four unique blocks that were presented to participants in counterbalanced fashion. The listeners were 281 European American undergraduate students from west Michigan (N=281). Dependent measures included accuracy of identification and confidence ratings as well as the identification reaction time and rating reaction time associated with the judgments. For identification reaction time the main effect of phonetic complexity was statistically significant such that listeners' reaction times for speaker identification were faster when the perceptual stimulus was more phonetically complex. Speaker ethnicity was statistically significant as well as listeners identified speakers as African American more rapidly than when they identified speakers as European American. There was a statistically significant main effect of speaker gender such that listeners' reaction times were faster when identifying a speaker as male rather than female. For confidence rating reaction time the main effect of phonetic complexity was significant with listeners rating their confidence level faster when the perceptual stimulus was less phonetically complex. Speaker ethnicity was also significant as listeners were faster at rating their confidence level when the perceptual stimulus was perceived to be an African American speaker as compared to when the perceptual stimulus is perceived to be a European American speaker. Finally, speaker gender was significant with listeners faster at rating their confidence after identifying the speaker as a male rather than identifying the speaker as female. These findings suggest important implications for educational, forensic, and business applications with respect to linguistic profiling and perceptual stereotyping.



Sentence Figurativeness and Modality Shape the Neural Bases of Language Processing

Ashley Drew, Elizabeth Miller and Nathan Axdorff Mentor: Dr. Gwenda L. Schmidt Department of Psychology

Conflicting findings in the study of the neural processing of metaphorical language may be attributed to confounding features of the stimuli including the modality (e.g. auditory, visual, etc.) of the word used metaphorically. Differences in brain activity due to modality would support an embodied account of cognition. To clarify the role of figurativeness (literal vs. metaphor) and modality in language processing, a highly controlled set of stimuli divided into three figurativeness conditions (literal, metaphor and anomalous) and two modality conditions (auditory and motion) was used. The dependent measure was the N400 amplitude, an event-related potential (ERP) component 400 ms post-stimulus which indexes semantic processing difficulty. It is derived form electroencephalographic (EEG) recordings at the scalp. Both figurativeness and modality were predicted to affect the size and scalp distribution of the N400 amplitude. Sentences included auditory literal ("His comeback was a haughty snort"), auditory metaphor ("Her limousine was a privileged snort"), motion literal ("The blow was a single punch"), motion metaphor ("The editorial was a brass-knuckle punch"), and anomalous. Sixteen righthanded native English speakers indicated which figurativeness category (literal, metaphor, or anomalous) they believed the sentences belonged. A repeated measures ANOVA revealed greater N400 amplitudes for metaphorical sentences than literal sentences. However, this effect may be confounded by the familiarity, naturalness, and imageability of the sentences. An interaction between figurativeness and modality was educed by literal auditory sentences producing greater N400 amplitudes than literal motion sentences, whereas motion metaphors produced greater N400 amplitudes than auditory metaphors. Furthermore, an interaction between modality and electrode site derived from greater N400 amplitudes for motion based sentences seen in the left posterior and left central electrode sites. These findings provide evidence to support an embodied, sensory-motor account of language, modulated by figurativeness and support the need for controlled stimuli regarding familiarity, naturalness, imageability, and modality factors.

Lexical Class and Explicitness as Neural Modulators of Metaphor Comprehension

Liz Fast, Audrey Weil, Ashley Drew and Elizabeth Miller Mentor: Dr. Gwenda Schmidt

Department of Psychology

Inconsistent results due to poorly controlled stimulus sets have pervaded research on the neural basis of metaphor. Previous studies have not often considered the part of speech of the metaphorical word or the explicitness of the metaphorical phrase. Most previous work has focused on metaphors that are nominal (use a noun metaphorically) and explicit (state a clear metaphorical comparison that is directly mapped). Because nouns and verbs possess different neural bases, it may be that nominal and predicate metaphors also have different neural substrates. Research has begun to explore predicate metaphors (where verbs are used in a metaphorical sense) which by nature are implicit (a metaphorical comparison that is indirect or implied). A highly controlled stimulus set was used in an event related potential (ERP) study. ERPs are derived from electroencephalographic (EEG) data collected at the scalp. Stimuli were nominal explicit metaphors (The unexpected divorce was an earthquake) nominal implicit metaphors (The relationship could not withstand the earthquake) or implicit predicate metaphors (Over the canvas the paint danced). Literal sentences (There was chaos in the city after the earthquake) and anomalous sentences (He sloppily taped the picture to the earthquake) served as controls. Brain activity was recorded from 64 electrodes on the scalp of right-handed native English speakers (n=18). Participants decided whether each randomly ordered sentence was literal, anomalous or metaphor. Metaphors elicited a larger N400 (an ERP index of semantic processing difficulty) than literal sentences for both predicate and nominal conditions The difference in N400 between literal and metaphor supports unique neural mechanisms of figurativeness which is not modulated by part of speech. For nominal sentences, the scalp distribution of the N400 was marginally different for implicit and explicit sentences. It is possible that the explicitness of the metaphorical comparison modulates neural processing.

This research was supported by the Howard Hughes Medical Institute.

Children and Art: Exploring the Correlation between Art Activities and Positive Emotion/Happiness in Preschoolers

Amanda Norris

Mentor: Dr. Sonja Trent Brown Department of Psychology

Since the late 1940's art therapy has been a growing field of psychotherapy shown to be effective with a wide range of clients, including but not limited to, children. This study is focused specifically on how children feel about art and its ability to promote positive feelings and emotions. The purpose of this study is to assess the extent to which children will connect art with positive emotion; a second question explores whether there are gender differences with respect to connecting art with emotion and happiness, finally a third explorative question is whether older children will connect art with happiness with a higher frequency than younger children. The population included in this study is preschoolers at 3, 4, and 5 years of age both male and female. Each of the children who participated in this study. Some of the black and white images depicted children participating in artistic activities while other images showed children performing other developmentally appropriate activities. Each child was presented with a doll and told that the doll was very sad and that their help was needed to make the doll feel better. Children were then required to point to the picture of the activity that would help make the sad child (doll) feel better/happy. Results are presented for art compared to other activities, for gender outcomes and for age.

An International Examination of the Tritone Paradox

Kirsten Peterson

Mentor: Sonja Trent-Brown Department of Psychology

Languages are either tonal, conveying word meaning by vocal inflection and pitch contours, or they are intonation-based, merely conveying a speaker's emotions and overall implications. Studies such as the one conducted by Pfordresher and Brown have shown that speakers of a tonal language (such as Mandarin) have an increased perception of musical pitch in some forms. Further examination of the relationship between intonation-based languages and musical perception is in order. Specifically, the tritone paradox first established by Dr. Diana Deutsch involves a pitch interval that is heard differently by listeners depending on their native region and lends itself well to such an investigation.

This study seeks to examine the responses of Mandarin and Cantonese speakers as well as English speakers' to the tritone paradox for perceptual significance. The paradox involves two notes played sequentially, with the participant recording whether the second pitch was higher of lower than the former. Participants will be assigned a participant number and will fill out a language background questionnaire and a musical background questionnaire. They will then be administered the tritone paradox test, which involves a CD being played and a multiple choice response sheet. Analysis of native language and participants' regions of origin will seek to show the extent to which both variables influence pitch perception. It is expected that language will have a greater impact on perception, although a participant pool from various areas within each country will be necessary to separate the two variables.

It is anticipated that trends in responses of the two ethnic groups will mirror the results already found in previous studies, that one group will provide significantly different responses than the other. Patterns of responding groups are discussed. It is also predicted that greater musical experience will correlate with significant trends in perception.

Sport and Gender Differences in Injury and Stress Among Division III Athletes

Andrew Rose

Mentor: Dr. Scott VanderStoep Department of Psychology

Recent attention has been given to injuries in youth sports, specifically with regards to early specialization and athlete stress. However, little research has attempted to link injury to other psychological or participation variables. The purpose of this study was to examine gender and sports-specific differences in injury and athlete stress. Eight-hundred and ninety-five Division III collegiate athletes were sampled in the spring of 2009. The questionnaire assessed five different aspects of sports participation. Results showed differences in swimmers compared to other selected sports (baseball, basketball, football soccer). First, swimmers reported that they began participating in sports at a later age than the other four sports (6.98 vs. 5.81 years, t(489) = 4.68, p<.001). Second, swimmers had significantly fewer acute injuries than the other four major sports (60% vs. 91%, X2(1) = 49.1, p<.001). Third, swimmers felt significantly less stress from coaches than the other major sports (3.33 vs. 3.90 on five-point scale; t(487) = 4.69, p<.001). Results also showed three significant differences with respect to gender. First, female athletes reported more stress than males did from both their mothers (1.78 vs. 2.03 on a five-point scale, t(887)=3.54, p<.001) and fathers (2.06 vs. 2.25 on a five-point scale, t(887)=2.21, p.027). Second, females more strongly agreed that parents put too much pressure on youth athletes (3.70 vs. 3.52 on a five-point scale, t(888)=2.68, p.007). Third, females reported a higher prevalence of chronic injuries than males (62% vs. 51%; c2 = 11.75, p=.001), despite starting athletics at a later age (6.52 vs. 6.03 years; t(878) = 2.95, p=.003). The findings have implications on the assessment of the psychological and physical health in youth sports culture.

Parents' Perceptions of Youth Sports

Cory Schmidt Mentor: Dr. Scott VanderStoep Department of Psychology

At least 30 million children participate in sports each year (Brenner, 2007), yet one in three children quits a sports team each year (Hyman, 2009). Children can experience burnout as their intensity of involvement increases. In a study by Wiersma and Fifer (2008), only one parent out of 55 mentioned the healthy benefits of youth sports involvement. Increased participation has also created increased injury rates. About half of these are overuse injuries, which are more serious in developing children (Brenner, 2007). The present study conducted structured interviews of parents regarding their views of children's athletics. Eighteen parents of competitive youth athletes (13 mothers, 5 fathers), ages 37-58 years (M = 47.5) years, participated. The participants' children were 26 girls and 20 boys, ages 5-26 years (M = 16.3). The interview consisted of thirteen questions regarding general experiences in youth sports, rest time, and injury history. Two themes that emerged were conceptually related, but a third theme seemed contrary to the reported behaviors and attitudes. First, all children were encouraged by a non-parent to play elite sports, and most parents felt that it was necessary to make their high school teams. Second, all parents agreed that the cost of youth sports was very high, but parents felt helpless about do anything about it. Third, the goals of most parents were for their children to make friends, learn to work with others, and have fun in sports. These goals would seem to be obtainable without the costs and travel demands of elite participation, which the parents view as necessary. This study confirms that the goals of most parents are consistent with recommendations of practitionersbalance, avoiding overuse, and a focus on fitness. However, the intense nature of youth sports can force children's sports participation to become excessive.

PSYCHOLOGY

Women's and Men's Investment in Work in the Later Stages of the Family Life Cycle

Kerry Smith

Mentor: Dr. Patricia Roehling Department of Psychology

While much is known about the effects of the early stages of parenthood on women's and men's work life, little is known about men's and women's orientation to work during the later stages of family life. Using data from the 2008 National Study of the Changing Workforce, we examine men's and women's investment in the workforce during the later family life stages, focusing on work hours, preferred work hours, and engagement with work, using gender role as a moderator. While workforce attachment was relatively unaffected by family life stage among men, women had increasing workforce investment during the later life stages, peaking in the empty nest stage.

Acoustic Variation in Child Speakers across Gender, Age and Ethnicity

Ryan Tussey, Jacqueline Canonaco, Chelsea Lynch, and Kirsten Peterson Mentor: Dr. Sonja Trent-Brown Department of Psychology

Listeners can identify adult speakers with respect to gender and ethnicity by attending to perceptual cues in the acoustic signal (Thomas & Reaser, 2004, Trent-Brown, 2004). This study explores the age at which these acoustic parameters begin to vary. Hillenbrand et al. (1995) conducted an analysis of the American English vowel space and published target acoustic descriptions for men, women, and children. Results were presented for "children" (ages 10-12), across gender, with no mention of ethnicity. Although the adult voice is typically achieved at age 14 for girls and age 15 for boys (Berger, 2008), there's a gradual lowering of the voice beginning with the onset of puberty as early as age 10 (Teen Growth, 2000), indicated by lower fundamental frequency (F0). Studies have provided evidence of both perceptual and acoustic variation with respect to speaker ethnicity (Trent-Brown, et al., 2009). Child speakers were recorded producing neutral context (/h-vowel-d/) words and sentences containing those target words. Speaker productions were screened for dialects. Acoustic variation was measured in terms of differences in temporal and spectral acoustic features such as vowel duration, fundamental frequency, and formant resonance frequencies. A multivariate analysis of variance showed significant differences for both age and gender. For gender, there was a significant fundamental frequency variation, with higher values for girls than for boys. There was also a significant difference for F0 with respect to age, such that as age increased, fundamental frequency decreased. These findings are in the expected direction, mirroring adult patterns, suggesting that gender and age are acoustically important considerations when conducting research with child speakers. Analysis of the data exploring variation across ethnicity is currently underway. Implications are evident for acoustic analysis of child corpora, for awareness of linguistic profiling (Baugh, 2005) and for educating teachers of diverse students.

PSYCHOLOGY

The Effect of an Outdoors Nature-Based Intervention Program on the Development of Early Literacy Skills in Preschool Aged Children

J. Davis VanderVeen, Gabriel Casher, Ryan Cotter, Kelsey Hawkins, Amanda Schab, Sara Dykstra, and Ann Frisella Mentor: Dr. Sonja Trent-Brown

Psychology Department

Evidence suggests that children who spend more time outdoors are healthier, happier and smarter (Kellert, 2005; Wells, 2000). The Ready For School initiative in Holland, MI joined with the Outdoor Discovery Center Macatawa Greenway to do a nature-based intervention program with preschools in the area. There were two groups of participants in this study: those in the experimental group in the outdoor intervention program, and those in the control group not given the outdoor intervention. The outdoor intervention program consisted of a nature lesson and exposure to the outdoors. The goal of the Ready For School initiative is "ensuring that every child from birth enters kindergarten prepared to succeed" (RFS, 2008). In addition, they "recognized early childhood education as the single-most important challenge facing our present and future development" (RFS, 2008). We looked to find a potential link between exposure to the outdoors and the development of early literacy skills in children between the ages of three and five. The GRTR! test designed by Lonigan and Whitehurst (2001) and modified by Molfese, Molfese, Modglin, Walker, & Neamon (2004) is a screening tool used to test the early reading skills of preschool aged children. The GRTR! test has three subtypes of questions: print knowledge, emergent writing and phonological awareness. A pretest/ posttest design was used in this study. The results of a Multivariate Analysis of Variance test show that there was a greater improvement of GRTR! scores in the outdoor group than the control group. The improvement from pretest to posttest in the ODC intervention group was 3.98 points on the GRTR! test compared to 2.71 points in the control group. This difference was statistically significant ($F_{(2.103)}$ = 5.620, df= 103, p=0.005, ηp^2 =0.098). This shows that spending more time outdoors improves the development of early literacy skills in preschool aged children.

This research was supported through funding from the Howard Hughes Medical Institute and the Kellogg Foundation.

The Relationship Between Stress, Rest, and Injury Among Division III Athletes

Rebecca Palmitier

Mentor: Dr. Scott VanderStoep Department of Psychology

Practitioners working with youth athletes usually advise against several physical and psychological risk factors: starting organized sports too young, playing weekend tournaments, heightened involvement and pressure from adult coaches and parents. The purpose of this study was to test if the findings from the clinical literature related to stress and rest are also found in a sample of successful college athletes. The questionnaire assessed five areas: demographics and sports participation history, attitudes towards sports and perceptions of stress in sports, sports injury and training history, general attitudes about youth sports, and beliefs about the role of parents in sports. Two major findings were identified; one related to athlete stress and one related to time off from sports. First athletes who felt high stress from coaches and parents began playing sports at an earlier age. Those who felt high stress from coaches were out for more weeks due to injury. Also, there were differences found between ever having a chronic injury and never having (muscle/tendon, bony, and ligament/joint). Second, athletes who had suffered from chronic muscle/tendon, acute bony or acute ligament/joint injuries said that they rest for fewer days per week out when out of season compared to those who did not suffer those injuries. Whereas, in-season rest was only significant with one of the injury types (acute ligament/joint). The current study confirms what practitioners have started to warn against. Specifically, reducing stress from adults may provide the healthy benefits of delay children's entry into team sports and may reduce injury. Also, in this sample, athletes who took adequate rest lowered the risk of several different types of injuries. Given that these findings occurred in a sample of successful athletes suggests that reducing stress and providing rest are at least as important in broader populations.

PSYCHOLOGY

Voice Quality: Listener Identification of Speaker Gender and Ethnicity

Imari Smith, Kukua Hinson, Ryan Tussey, Jacqueline Canonaco and Chelsea Lynch

Mentor: Dr. Sonja Trent-Brown Department of Psychology

Consider the phenomenon in which one hears a voice on the radio or speaks to an unknown individual on the telephone. Although unseen, we often create a mental image of the person to whom we are speaking – is the person male or female, tall or short, thin or muscular? If we were to meet the person at a later point in time, we might find that our perceptions were right on target, or, conversely, off the mark. Still, the fact that we are able to create an image at all suggests that there is information available in the auditory signal that we access to perceptually interpret and identify speaker characteristics. African American and European American male and female listeners identified speaker gender and ethnicity and rated their confidence in their responses. Listener reaction time was also measured for both the identification responses and for the confidence ratings. Data were analyzed for the effects of both speaker and listener characteristics. Overall, European American male speakers were the most accurately identified and African American female speakers were the least accurately identified. Listener gender was significant for European American listeners (female listeners were more accurate) but not for African American listeners, which may suggest that ethnicity has greater salience for the African American listeners. There were significant differences for identification reaction time and for rating reaction time with respect to both speaker gender and speaker ethnicity. Significant effects were also found for the median confidence ratings across experimental conditions. These findings have implications for teachers of diverse students, linguistic profiling, telephone interviewing, forensic applications, vocal training and voice therapy, computerized or synthetic speech applications and for the fields of psycholinguistics and psychoacoustics.
SOCIOLOGY AND SOCIAL WORK

Social Correlates with Childhood Obesity

Samuel Fishman, Trevor Lake, Caitlin Roth, Rebekah Taylor and Jonathan Vanderbeck Mentor: Dr. Pamela Ray Koch Department of Sociology and Social Work

Childhood obesity is a social problem of growing concern in the United States. Recent national campaigns aim to reduce the proportion of children who are obese in this country. these movements focus on the health consequences of childhood obesity, and the exercise and food consumption precursors to childhood obesity. This research project aims to expand the attention on childhood obesity to include the social dimension. Our research investigates how social factors can correlate with becoming overweight or obese in childhood. Further, our research investigates what social correlates occur after a child becomes overweight. Our research utilizes the Early Childhood Longitudinal Study (ECLS-K) from the National Center of Education Statistics.

The Big Bad Wolf: Is the Image Still Present in the Minds of Michiganders?

Matt Herm

Mentor: Dr. Roger Nemeth Department of Sociology

A proposal to remove the gray wolf from the Endangered Species list in the Western Great Lakes region will place responsibility of wolf management on state agencies. Along with Minnesota and Wisconsin, Michigan will have to implement its own plan to manage wolf populations in the future. While the size of the wolf population has grown considerably in the past two decades, attitudes of residents toward wolves and their future remain uncertain. This study measures the "social carrying capacity" for wolves in northern Michigan. The survey consisted of 1,053 northern Michigan residents, asking questions regarding their support and fear of wolves, as well as their approval of methods for state management. The results show that, while there continues to be strong support for wolves in Michigan, since 2005 there has been a significant decline in support for wolves and an increase in fear of the animal. These findings reveal that the wolf population may be exceeding the social carrying capacity for the creature. Also found is a growing polarity of opinion among Michigan residents, indicating that the topic of wolves may result in a culture war for northern Michigan. Since the state will need to develop a management plan in the near future, the findings of this research have direct policy implications.

This research was supported by a GLCA New Initiatives Grant and a Hope College Nyenhuis Student-Faculty Summer Development Grant.

The Milk and Medicine Program Evaluation: Lusaka, Zambia

David Jon Blystra, and Lindsey Nicole Boeve Mentor: Dr. Deborah Sturtevant

Department of Sociology and Social Work

The HIV and AIDS epidemic is sweeping through Zambia, Africa at an unsettling rate. This epidemic plays a dramatic part in the increase of orphans and vulnerable children. The Christian Alliance for Children in Zambia (CACZ), a faith-based, non-governmental organization implemented its Milk and Medicine Program in 2004. CACZ's goal is, "to improve child health and strengthen families to prevent child abandonment and institutionalization." The program distributes nutritional supplements, medicine and limited social work support for those involved in the program. It has served approximately 300 children since its inception. This research seeks to understand the efficacy of the Milk and Medicine Program.

The purpose of this on-going research, conducted annually through 2012, is to provide an understanding of the aggregate data to enable CACZ to provide services to orphans and vulnerable children so that they may thrive. This particular study analyzed over ten variables that included weight and age comparisons to Zambian normal growth charts for a sample size of 107 children. The proportion of weight gained for the children who were underweight on admission compared to growth chart weights is 8% for the group, 8% for boys, and 9% for girls. Based on these findings, our recommendations included adding vitamin and mineral supplements, improving and standardizing record keeping, and adding length to the data. The results demonstrated a strong relationship between length of time in program and weight gained and supported the case for long-term infant feeding programs for orphaned and vulnerable children.

This research was supported by The Alliance for Children Everywhere

Stories from the Near East: Learning About Culture through Letter Writing

Anne Jamieson Mentor: Dr. Donald Luidens

Department of Sociology and Social Work

For the greater part of human history, letter writing has been an important tool of communication between people separated by distance. Letters reveal important information about the culture and climate of the times and places they were written in. One such set of letters was that of Edwin and Ruth Luidens, missionaries writing from the Middle East home to their parents in the United States between 1944 and 1964. Over the course of the summer, these letters were organized and digitized by the author. As this project will demonstrate, a great deal was learned about Middle Eastern culture in the 1940s through the 1960s, and about the culture surrounding Missionary work and those who choose to make it their life's work.