Apr 17th, 8:29 AM - 9:00 AM

Complete 1999 Program

ILLINOIS WESLEYAN UNIVERSITY

TENTH ANNUAL

JOHN WESLEY POWELL • IWU

STUDENT RESEARCH CONFERENCE

To Recognize the Research Projects of IWU Students

April 17, 1999

Center for Natural Science

http://www.iwu.edu/~jwprc/research.htm

Tenth Annual

John Wesley Powell • IWU

Student Research Conference

Science Commons

Center for Natural Science

Saturday, April 17, 1999

9:00 a.m. – 4:30 p.m.

Official Program

SCHEDULE OF EVENTS

Saturday, April 17, 1999

9:00 a.m.	Continental Breakfast and Poster Session A	Science Commons
10:30 a.m.	Oral Presentations - Concurrent Sessions	
	Session 1	Beckman Auditorium
	Session 2	Anderson Auditorium
12:00 p.m.	Lunch Keynote Address: Dr. Susan Kieffer	Main Lounge
1:30 p.m.	Poster Session B	Science Commons
2:30 p.m.	Oral Presentations - Concurrent Sessions	
	Session 3	Beckman Auditorium
	Session 4	Anderson Auditorium
4:00 p.m.	Presentation of Certificates and Phi Kappa Phi Awards	Anderson Auditorium

LUNCHEON KEYNOTE SPEAKER

"Rock Music: Not all Geologic Processes are Adagio; Give me the Scherzos!"

Dr. Susan Werner Kieffer

Susan Werner Kieffer, a MacArthur Fellow, earned a doctorate from the California Institute of Technology—illustrating the interdisciplinary nature of science, a key theme of IWU's student research conference.

Her main interests are geological physics, including disciplines like planetary sciences, solid-state geophysics, volcanic environments, and theoretical modeling with supercomputers.

Kieffer's career has taken her to teaching in classrooms at the University of California-Los Angeles, Arizona State University, and the University of British Columbia, to working for the U.S. Geological Survey—a federal agency once headed by John Wesley Powell, namesake of IWU's research conference and former IWU faculty member.

She is co-founder of Kieffer & Woo, Inc., a research company dedicated to investigating the nonlinear processes and prediction theory and to popularizing science and education. Kieffer also founded the Kieffer Institute for Development of Science-Based Education, a not-for-profit organization headquartered in Arizona.

Kieffer has been a member of the National Academy of Sciences since 1986, an organization with 1,615 members, only 150 of whom are geologists, geophysicists, geochemists, and representatives of related fields.

STUDENT PARTICIPANTS

Andersen, Carly	P1
Anderson, Andrew M.	P2
Blazek, Jesse	P3
Boyden, Andrew W.	O1.5
Brockman, Jonathan	P4
Bryant, Jay	P31
Bushyhead, Shana	O4.1
Butler, Christopher R.	P5
Centko, Rebecca S.	P6
Colburn, Darcia	P7
Dearing, Matthew	P8
Djikas, Evan T.	O1.4
Estle, Sara	P9
Ettlie, Brad J.	P37
Feiner, Erika L.	O2.1
Flanagin, Virginia L.	O1.1
Floor, Anders	O1.3
Foust, Sarah	O2.2
Garver, Betsy	P11
Gavardinas, Kostas	P12
Glinka, Robert	P31
Godin, Abigail	O2.3
Hettlinger, Taryn L	O4.4
Hixon, Ernest	P13
Holly, Patrick, Jr.	P14
Holsen, Laura	P16
Hood, Jaclyn K.	P15, P24
Hunnell, Heather A.	P9
Kirk, Rebecca	P17, P31
Knod, Danielle	P18
Kolb, Jamie	P42
Korwel, Matthew	P31
Lathem, Alexandra	P19
Lindahl, Karen	P20
Majewski, Jerome C.	P21
Manning, Shelley	O2.4
Martello, James	P22
Mateja, Daniel N.	P23
Migal, Natalia K.	P24
Moecker, Sarah	P25
Monk, Keith A.	P26
Nelson, Benjamin J.	O3.3
Nielsen, Kimberly	P27
Nowicki, Brian	O4.2
Ralston, Scott	O3.2
Rau, Ileana G.	P28
Rehagen, David	P31
Reining, Angela M.	P29
Reitzel, Adam	P30
Ritger, Andrew	P31, O1.2
Sabaka, Karen A.	P32
Schroeder, Rebecca	P31
Schrum, Ethan	P33
Sheets, Steven A.	P34
Stewart, Chris	P31
Suhr, Sarah	P35
Tassin, Joy M.	P36
Taylor, Justin B.	O3.4
Tuite, Adam J	P37
Steven A. Tymonko	P38
Van Dyke, Jennifer	O3.1
Wansley, Joshua	O4.3
Widicus, Susanna	P39
Wieland, Mark	P10
Zalokar, Michael	P31

ORAL PRESENTATIONS - SESSION 1
10:30 - 12:00
BECKMAN AUDITORIUM (C102)
CHAIR: JENNY VAN DYKE

1.1	Virginia Flanagin
1.2	Andrew Ritger
1.3	Anders Floor
1.4	Evan Djikas
1.5	Andrew Boyden

ORAL PRESENTATIONS - SESSION 2
10:30 - 12:00
ANDERSON AUDITORIUM (C101)
CHAIR: KELLY PIEPENBRINK

2.1	Erika Feiner
2.2	Sarah Foust
2.3	Abigail Godin
2.4	Shelley Manning

ORAL PRESENTATIONS - SESSION 3
2:30 - 4:00
BECKMAN AUDITORIUM (C102)
CHAIR: ESTEBAN LIZANO

3.1	Jennifer Van Dyke
3.2	Scott Ralston
3.3	Benjamin Nelson
3.4	Justin Taylor

ORAL PRESENTATIONS - SESSION 4
2:30 - 4:00
ANDERSON AUDITORIUM (C101)
CHAIR: SHELLEY MANNING

4.1	Shana Bushyhead
4.2	Brian Nowicki
4.3	Joshua Wansley
4.4	Taryn Hettlinger

Note: Student's name is underlined, faculty advisor designated with *

Presentations are approximately 15 minutes in length, followed by up to 5 minutes question-and-answer period as time permits.

Oral Presentation 1.1

ORGANOCHLORINE PESTICIDE LEVELS IN BIRDS FROM NORTHWEST COSTA RICA

Virginia L. Flanagin and R. Given Harper* and Jeff A. Frick*
Department of Biology, Illinois Wesleyan University

Organochlorine pesticide contamination has been shown to occur in locations previously thought to be untouched by humans (Dulzen 1991). This is due in part to the ability for organochlorine pesticides to travel long distances through the atmosphere (Standley and Sweeney 1995). In Costa Rica, pesticide use occurs on the Caribbean side of the mountain range that divides the country longitudinally, therefore little pesticides should be found on the Pacific side of the mountain range where very small amounts of pesticides are used. We looked at the frequency and amount of pesticide contamination in birds from three locations in Northwest Costa Rica, running from the Caribbean side to the Pacific side of the country. Two of the sites were used in order to compare our data with those obtained by Standley and Sweeney (1995) on stream mayfly larvae in similar locations. We found that the frequency of contamination at two of the sites corresponded to those found by Standley and Sweeney (1995), such that the highest frequency of contamination occurred at the site closest to agricultural areas. Biomagnification is also a documented phenomenon where pesticides accumulate in higher levels in organisms at higher trophic levels. We did not however find this to be the case in our data, for the insectivorous birds that we sampled had pesticide levels comparable to those found by Standley and Sweeney(1995) in invertebrates. We conclude that although more pesticides were found at locations closer to agricultural sites, like expected, the phenomenon of pesticide accumulation in the tissues of avifauna is much more complex than originally anticipated.

Oral Presentation 1.2

DESIGNING AN INTEGRATED ENVIRONMENT FOR ARTIFICIAL INTELLIGENCE

Andrew B. Ritger and Lionel R. Shapiro
Department of Computer Science and Mathematics, Illinois Wesleyan University

The Shelley Research Group (part of the Illinois Wesleyan Intelligence Network on Knowledge - IWINK) has been in existence for several years, and has benefited immensely from various student contributors who have added such components as robotic arm control, cross platform networking, an artificially intelligent tic-tac-toe player, and an interactive teaching tool demonstrating the functionality of artificial neural networks. What is lacking, however, amidst these undergraduate contributions to the Shelley project, is an effective means of integrating existing components into a single cohesive functional unit, let alone any easy means of making further contributions within a simple unified context.

The focus of this research has been to design an all-encompassing structure for incorporating the different components of Shelley (both existing and future). Because we must operate under the assumption that we cannot predict what future contributions will be made to Shelley, nor how these components will be used, this integrated environment must be both flexible and expandable in such a way as to not confine future projects.

The pursuit of artificial intelligence relies heavily upon interaction with the surrounding environment. For this reason, many of the existing components are devices for receiving input from Shelley's surroundings (such as vision cameras) or acting upon the surroundings (such as robotic arms). Thus, we can assume that future contributions will fall under two primary categories: additional devices (either cognitive modules, such as neural networks, or interactive devices, such as cameras or arms), or intelligence agents (such as tic-tac-toe players, or navigation systems) which will use these devices. The environment must then be flexible in two manners -- allowing for the addition of further devices, and a task management mechanism for accessing these devices. The solution is to use a modern operating system model where the devices which Shelley uses to interact with her environment correspond to computer hardware devices and their drivers, the intelligence agents are analogous to processes which run on the system and use the devices, and the task manager which coordinates these agents and their usage of devices can be compared to the modern kernel.

Oral Presentation 1.3

MEASURE CHAINS AND LASALLE'S INVARIANCE PRINCIPLE

Anders Floor and Zahia Drici*
Department of Mathematics, Illinois Wesleyan University

Measure chains are special subsets of the real line. The real line itself and all its discrete subsets are examples of measure chains, but many subsets containing combinations of continuous intervals and discrete points are also measure chains. The calculus on measure chains is thus an extension of the differential and difference calculuses. The axioms of defining measure chains will be given, and basic concepts and theorems in the measure chain calculus will be presented. Some results on stability (which culminate in Lasalle's Invariance Principle) will be presented in both a differential calculus and a difference calculus context; the hope is to extend these results to the measure chain calculus.

Oral Presentation 1.4

HOW ACUTE ARE TODAY'S STOCK MARKET INVESTORS? TRACKING CONVENTIONAL WISDOM THROUGH IMPLIED VOLATILITY.

Evan T. Djikas and Narendra K. Jaggi*
Department of Physics, Illinois Wesleyan University

In 1973, Fischer Black and Myron Scholes[1], and Robert Merton[2] developed a novel, deterministic algorithm, which could, given a realistic set of assumptions about the volatility of the market, compute the rational price of European call options. This pioneering work placed options-pricing on a rational footing, and was recently (1997) honored by awarding the Nobel prize in Economics. We have inverted this algorithm to impute, by iteration, the implied volatility _ of the underlying stock[3] and infer market opinion of future price movements.

We have tracked options on stocks under heavy speculation to discern the investor sentiment surrounding these stocks, by extracting the implied volatility of the stock price. Issues surrounding the accuracy of investor sentiment on these stocks will be addressed.

[1]F. Black and M. Scholes, "The pricing of options and corporate liabilities",
Journal of Political Economy, vol 81 (1973) 637-654
[2]R. Merton, "Theory of rational option pricing",
Bell Journal of Economics and Management Science, vol. 4 (1973) 141-183
[3] P. Wilmott, S. Howison and J. Dewynne,
" The Mathematics of Financial Derivatives", Cambridge University Press (1995).
This is a comprehensive introduction to the underlying mathematics.

Oral Presentation 1.5

NUTRIENT ASSIMILATION IN DEVELOPMENTAL STAGES OF THE PURPLE SEA URCHIN, ARBACIA PUNCTULATA

A.W. Boyden and Elizabeth Balser*
Department of Biology, Illinois Wesleyan University

The capability of the developmental stages of sea urchins to assimilate protein and polysaccharide tracers was determined. Although the uptake of small nutrient molecules like amino acids and simple sugars from the surrounding medium occurs in early developmental stages of sea urchins (Schneider, 1985), the results presented here are the first report of active uptake of large proteins and polysaccharides. Unfertilized and fertilized eggs, blastulae, prism larvae, 2-arm feeding plutei, 4 to 6 week old larvae, and early juvenile stages were all examined. These various developmental stages were exposed to iron-containing ferritin (a protein) and iron dextran (a polysaccharide). The Prussian blue reaction, which demonstrates the presence of iron, was then employed to confirm the presence of the iron tracers inside the animals. After exposure to the tracers and the Prussian blue reaction, the animals were preserved and processed for examination by light microscopy. Our results show that pre-feeding stages, including fertilized eggs, blastulae, and prism stages, are capable of uptake of ferritin. Additionally, our results show that the ability to incorporate this tracer is concomitant with fertilization. Unfertilized eggs incorporate neither tracer, and non-feeding stages are incapable of assimilating iron dextran. Uptake of dissolved organic molecules by embryos of planktonic larvae may augment maternal contribution to the egg and improve survivorship.

Oral Presentation 2.1

FROM CATHOLICISM TO BUDDHISM? THE EFFECT OF JACK KEROUAC'S CATHOLIC UPBRINGING ON HIS SEARCH FOR ENLIGHTENMENT IN THE DHARMA BURNS

Erika L. Feiner and Dan Terkla
Department of English, Illinois Wesleyan University

Summary: In the Dictionary of Literary Biography for the Beat generation, George Dardess suggests that Jack Kerouac's Catholicism is a subject that "has never been sufficiently stressed by commentators." Indeed, Catholicism played a significant role in his life especially when he began an intense study of Buddhism. In his novel, The Dharma Bums, Ray Smith, a fictional rendition of Kerouac, searches for Buddhist enlightenment, but his strict Catholic background caused him to depend on his Zen teacher rather than look within himself to find the truth.

Oral Presentation 2.2

THE TEMPEST: A SHAKESPEAREAN MEDITATION ON ART AND ARTIFICE

Sarah Foust and Dan Terkla*
Department of English, Illinois Wesleyan University

David Lodge proposes that in the reading process, "Every Decoding is another encoding." With each reading of a work, a reader brings something new, allowing for the possibility of a new interpretation of the text. In *The Tempest,* William Shakespeare employs conventions such as openendedness, intertextuality, and aesthetic distance in order to comment upon the dichotomy between art and reality, ultimately leading the reader to participate in the art itself. By allowing for an unending dramatic dialogue, especially provided for in the epilogue of the work, artists/readers like Peter Greenaway are allowed entrance into the text. When read parallel to Greenaway's interpretations on the text, *Prospero's Books,* a film that emphasizes the importance of image, word, and the creative process, a reader is moved to notice not only Shakespeare's comment on artistic prowess, but on his or her own integral role in the reading process.

Oral Presentation 2.3

FEMININE OR FEMINIST: ISSUES SURROUNDING WOMEN'S ADDRESSES AT THE FIRST NATIONAL CONSERVATION CONGRESS

Abigail Godin and Michael Young*
History Department, Illinois Wesleyan University

This paper is a portion of a larger research project. The project as a whole focuses on women in the early conservation movement and their perceptions of the land. I use Frederick Jackson Turner's frontier thesis to define what the unsettled West symbolized for women in the late nineteenth and early twentieth centuries. While Turner ignores the position of frontier women almost entirely, his thesis is applicable to their experiences and perceptions. By considering Turner's thesis from a feminist standpoint, I prove that the West symbolized greater freedom and more possibilities for women than they had previously experienced. Hence, women's participation in the conservation movement arose from their desire to maintain this unsettled land as a symbol of their freedom from constraining traditions.

Many scholars have argued that women became involved in the conservation movement as an extension of their roles dictated by the ideals of true womanhood, which dictated that a woman's domain was the home, and her primary roles were as a mother and a wife. The conservation of natural resources for future generations would be a primary concern for a mother. While I believe that many women in the conservation movement supported certain aspects of this traditional ideal, most women also supported many feminist ideals. In this paper, I analyze three speeches given by women at the First National Conservation Congress in 1909, through which I prove that women maintained a balance between traditional ideals and modern feminist views, as a way of most effectively gaining rights in the movement. When the American frontier was declared closed in 1890, women found the possibility for equality gone; the conservation movement allowed them to search for new freedom of beliefs and expression, while permitting them to stay safely within the boundaries of true womanhood.

Oral Presentation 2.4

FROM LITERAL PATH TO TRANSCENDENT JOURNEY THE PILGRIM'S MOVEMENT THROUGHOUT *INFERNO*

Shelley Manning and Dan Terkla*
Department of English, Illinois Wesleyan University

Dante intended *The Divine Comedy* to be an instructional device for Christian salvation. According to his "Four Levels of Interpretation," Dante also understood that readers must interpret the poem in various ways in order for them to arrive at the same moment of full intellection that the Pilgrim reaches in *Paradiso*. While Aristotelian cosmology dictates the upward direction of his physical journey, gatekeepers mark the Pilgrim's uplifting intellectual and spiritual progressions. Dante's use of guards dates back to the ancient Apocalyptic literature where gatekeepers stop souls traveling through heaven to ask their names and their reasons for being there. The gatekeepers illustrate the Pilgrim's increasing knowledge of sin throughout this poem.

Using *Inferno* as a test case, this study utilizes Aristotelian cosmology to map the Pilgrim's physical journey and employs the gatekeeper tradition to mark the Pilgrim's spiritual progression. By connection Dionysius' definition of anagogy with Dante's "Four Levels of Interpretation," this paper illustrates the parallel images of the Pilgrim's spiritual and physical journeys.

Oral Presentation 3.1

DOES IT PAY TO BE A MAN?
A STUDY OF PAY DIFFERENTIALS BETWEEN COLLEGE GRADUATES

Jennifer Van Dyke and Michael Seeborg*
Department of Economics, Illinois Wesleyan University

This paper examines whether or not there is a difference in the salaries of recent male and female college graduates. The human capital theory suggests that male and female college graduates, who studied in the same field, have similar education and little work experience, should have similar salaries. However, many studies have shown that men's starting salaries are greater than women's, and that over time the income gap increases.

My model focuses on 1986 college graduates from the National Longitudinal Survey of Youth database, and then follows these graduates through 1995. The results for my unique sample of college graduates confirm the general conclusion that men's starting salaries are greater than women's and that over time the income gap does increase.

Oral Presentation 3.2

CHINESE COMMUNIST PARTY LEADERSHIP IN THE COUNTRYSIDE: HISTORICAL CONTRADICTIONS AND CORRECTIONS

Scott Ralston and Tom Lutze*
Department of History, Illinois Wesleyan University

The key issue that propelled the Chinese Communist Party into prominence before 1931 was agrarian reform. This included land redistribution and the setting up of producer and consumer cooperatives. However, communal relationships would not be established in the countryside until 1958. The reason for this was the devastation that Ching Kai-shek's encirclement campaigns set on the Kiangsi Soviet which was established in November of 1931 and would end in October of 1934. By analyzing the agrarian reform in the Kiangsi Soviet the historical contradictions of Chinese Communism in the countryside are prominently displayed. These contradictions prevented the establishment of communal relationships in the countryside and undermined mass support for the Communists when they needed it most. This paper asserts that had the Chinese Communists moved immediately to establish communal relations they would have had much greater mass support and would have been much more likely to succeed against Chiang's forces.

Oral Presentation 3.3

LAS MUJERES DE ORO (GOLDEN GIRLS)

Benjamin J. Nelson and Carolyn Nadeau*
Department of Hispanic Studies, Illinois Wealeyan University

First published in 1605, at the height of the Golden Age of Spain, Part I of Miguel de Cervantes Saavedra's *Don Quixote de la Mancha* dared to challenge the overall relevancy of revering traditional literary ties in the creation of fiction. Instead of conforming to the literary requirements that the Middle Ages and Antiquity imposed on contemporary literature, Cervantes attempted to shake the stereotypes and expectations often present in this literary genre. Directing his attack on the widely popular books of chivalry, this Golden Age writer has his protagonist Don Quixote de la Mancha stumbling into the trap of categorizing all the women that he encounters as mere "damsels-in-distress," since the books of chivalry of this misguided Spaniard dictate that all women become powerless when faced with a problematic situation. After encountering the characters Marcela, Dorotea and Camila, however, the reader discovers that these women, through their creative and intelligent speeches and actions, possess the necessary power to successfully resolve their own problems. To break from the literary norm that all women are damsels-in-distress, Miguel de Cervantes presents these extraordinary women as independent and capable of overcoming the obstacles in their lives without requiring the intervention of a knight in shining armor.

Oral Presentation 3.4

BEYOND NARROW LIBERALISM

Justin B. Taylor and James Simeone*
Department of Political Science, Illinois Wesleyan University

Of growing debate among those concerned with American political culture and democratic theory is the modern conception of liberal democratic theory. This work attempts to broaden our understanding of democracy. I will argue that modern liberalism has narrowed our conception of individual liberty. This narrowed focus has produced a reliance on the use of public regulation and interest group pressure as substitutes for civic engagement. In an attempt to move past a mere critique of narrow liberalism, this essay will develop a research design and an empirical test to measure our current political culture's support for a robust democracy and its future prospects of development.

Oral Presentation 4.1

LISTENING TO THE NATIVE VOICE: MUSEUMS AS A MEDIUM IN CORRECTING NATIVE AMERICAN STEREOTYPES

Shana Bushyhead and April Schultz*
Department of History, Illinois Wesleyan University

Native Americans have historically been viewed as a static, and even dead culture. Of course this is simply not true. Native Americans are an evolving, ever-changing, ever-growing culture. I believe it is the responsibility of museums not only to educate on Native American culture, but also to promote contemporary artists and historians to show through example that Native American culture is not static.

My project consists of three parts. The first is to describe the responsibilities of museums to educate the general public on Native American culture and history, and also to educate Native Americans themselves in their own culture and history. In order to do this, I will first trace the history of museums' effect on Native culture and the country's view of Native Americans from about 1880 to the present. From this history, I will then show the importance of the museum as a medium in which to educate the public, and also the importance in the Native American community. Museums have the power to build community and self-worth, which is extremely important in a culture raising itself from years of oppression.

The second part is viewing, and evaluating several tribal museums. The tribal museums will consist of the Museum of the Cherokee Indian in Cherokee, North Carolina, the Southwest Museum in Los Angeles, California, and the National Museum of the American Indian which is associated with the Smithsonian Institute, but is still considered a tribal museum, albeit on a much larger scale. I will see how they incorporate different theories of museum studies in their museums, and how they handle problems specifically associated with Native American artifacts, such as repatriation and the display of sacred objects.

The final part will be a case study exhibiting the John Wesley Powell Collection housed in Sheean Library. The exhibition of these pieces will put into practice the theories and ideas gathered from the previous two parts.

Oral Presentation 4.2

BEYOND VIOLENCE AND KOOL-AID: TOWARD AN ORIGINAL METHOD OF CULT STUDY WITH THE BRANCH DAVIDIANS AND AUM SHINRIKYO

Brian Nowicki and Carole Myscofski*
Department of Religion, Illinois Wesleyan University

When approaching the subject of New Religious Movements (NRMs), commonly known as cults, one is immediately aware that NRMs are, in David G. Bromley's words, "unpopular." This impression is no doubt fueled the association of *cult* with images and reports of child abuse and weapons hoarding, torched buildings housing a group's faithful adherents, and busy subways bombed with poisonous gasses. Despite their infamy, cults such as the Branch Davidians and Aum Shinrikyo are nonetheless religious movements who have at their core issues of salvation and religious experience. It is the contention of this paper that cults and their study have been tainted by their misrepresentation in popular culture and that due to this misrepresentation NRMs are the unpopular subjects regarded as disparate, odd phenomenon spoken of only in terms of tragedy and dysfunction.

Understanding cults as legitimate forms of religious experience requires understanding both the perspective of study that defines cults as illegitimate and formulating a new paradigm concerned with preserving critical empathy, analysis, and interpretation. Using the Branch Davidians and Aum Shinrikyo as test cases, I will place the theoretical approaches of Max Weber, Mircea Eliade, and Claude Levì-Strauss in dialogue with each other, such that one can begin to understand how cult phenomenon is in fact a legitimate form of religious expression akin to the Jesus cults of Early Chriastianity. Additionally, contemporary cults such as the Branch Davidians and Aum Shinrikyo follow what I describe as a mythical narrative or script that analytically encompasses characteristics of NRMs such as charismatic leadership, discipline, and contrast identities while interpretively placing those same characteristics within a structural framework that permits an understanding of why cults express their religious fervor through violence. In this way not only can violence and religion be reconciled but a greater so too can the interconnected relationship between violence and a NRMs success be uncovered in such a way that the Branch Davidians and Aum Shinrikyo appear to be the most successful contemporary cults.

Oral Presentation 4.3

Joshua Wansley and Marina Balina*
Russian Literature, Illinois Wesleyan University

THE POET AS A PROPHET: PUBLIC AND PRIVATE SELF IN THE POETRY OF VLADIMIR MAYAKOVSKY

It was Stalin who first authoritatively declared that "Mayakovsky was and remains the greatest poet of our times." But even before Stalin canonized the name "Mayakovsky" in the history of the Russian revolution, his presence was ubiquitous. And there is an aspect of the great poet that survives his passing; the name is more a legend than it was ever a man. But uncertainty arises in the realization of this status. And complications compound in an environment of oppression. What is the legend of Mayakovsky? What command do the name and the works evoke to receive the blessings of Stalin? What tragedy impelled the legend, in a glaring detail strategically omitted by some, to eventually take his own life? In this essay, I will explore the tumultuous and enigmatic relationship of a poet and his time; the former characterized by exceptional talent and passion, the latter, oppressive to the creative facility.

In a irony worth recognition, Mayakovsky was, in his own words, a "worker-poet", and offered his work to the service of the regime that, in the esteem of some, was a subsisting factor to his suicide. It is evident that while the "public self" was openly content with the Soviet regime, there was a much more complex "internal self" that was discontent with the former, thus impelling the poet to take his life. What can be said of this division given the autobiographical leaning of much of Mayakovsky's poetry? Moreover, what is the disposition of the "internal self"? Of the "public self"? Was Mayakovsky driven to compliance out of weakness? Or was it out of the strength of his conviction that he supported the Revolution? This research project endeavors to analyze the poetry of Vladimir Mayakovsky through the prism of his life as a public and a private person and establish the lost connection within the creative persona under the suppression of a totalitarian regime.

Oral Presentation 4.4

THE PERPETUAL TODAY: THE USE OF TIME IN *ALICE'S ADVENTURES IN WONDERLAND*

Taryn L. Hettlinger and Mary Ann Bushman*
Department of English, Illinois Wesleyan University

The Victorian era was a period obsessed with Time and all things related to it. While Time and time measurement were by no means new concepts, current developments in science, industry, and society raised serious questions about the actual nature and meaning of time. The popular interest in Time is reflected in the literature of the period. Frequently, Time, as a symbol, was used to evoke images of hopelessness, death, and decay, yet in Lewis Carrol's *Alice's Adventures in Wonderland,* Time is manipulated for a different effect. In Wonderland, a different concept of time is created. The characters are removed from "rational" time, yet paradoxically, obsessed with its passage. While this passage is associated with only negative events, Carrol manages to reduce Time to nonsense, thus appealing to children through his creation of a perpetual today.

POSTER SESSION A

9:00 - 10:30 a.m.

Odd-numbered posters

POSTER SESSION B

1:30 - 2:30 p.m.

Even-numbered posters

Note: Student's name is underlined, faculty advisor designated with *

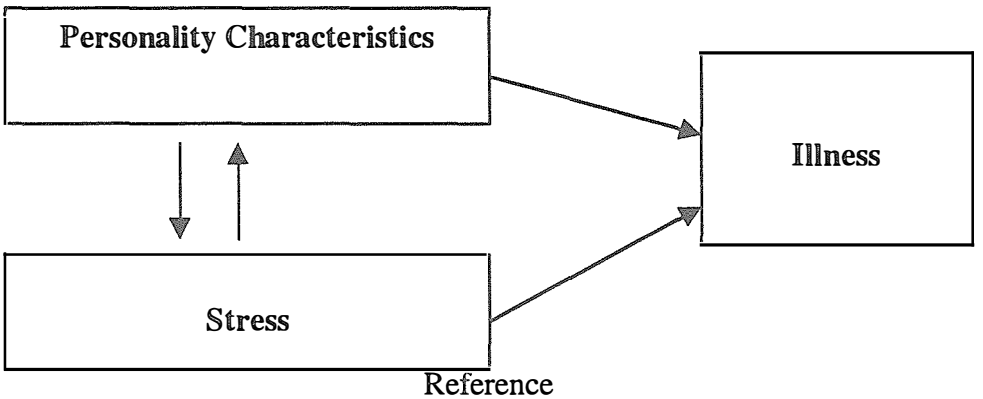
During each poster session the author will be present to discuss her or his research with conference attendees, and answer questions.

Poster Presentation 1

THE EFFECTS OF PERSONALITY CHARACTERISTICS AND STRESS ON PHYSICAL ILLNESS

Carly Andersen and Donna Hartweg*
School of Nursing, Illinois Wesleyan University

Recent research has indicated that personality characteristics and stress may influence the incidence of physical illness (Dreher, 1995). The majority of studies have examined personality characteristics and stress in acutely and chronically ill populations. However, this phenomenon has not been extensively studied in healthy populations. The purpose of this study was to examine the relationships among personality characteristics, stress, and physical illness in a sample of undergraduate students. This study tested a moderator model (see below) in which personality characteristics interact with stress to influence the incidence of physical illness using hierarchical multiple regression. Study participants included 55 undergraduate students selected from two classes from a small mid-western university. These two classes were chosen to represent the diversity of majors, gender, and year in school at the university. Personality characteristics were assessed with the measures of hardiness and assertiveness. A series of four surveys assessing hardiness, assertiveness, stress, and physical illness as well as a demographic sheet were distributed to study participants to be completed during class time. The analyses revealed significant correlations between the personality characteristics, hardiness and assertiveness, and stress. The data did not offer empirical support for the moderator model, thus suggesting that personality characteristics do not interact with stress to influence the incidence of physical illness. However this finding should be considered with caution since the measure used to assess physical illness may have limited sensitivity in this population. Future research is indicated using different measures of physical illness with greater sensitivity in healthy populations.



Reference

Dreher, H. (1995). The immune power personality: Seven traits you can develop to stay healthy. New York: Penguin Group.

Poster Presentation 2

NEW REAGENTS FOR ORGANIC SYNTHESIS APPLICATIONS OF BISMUTH COMPOUNDS IN ORGANIC SYNTHESIS

Andrew M. Anderson and Dr. Ram S. Mohan*
Department of Chemistry, Illinois Wesleyan University

Bismuth compounds are attractive candidates as reagents in organic synthesis due to their low toxicity and low cost. However, they have found limited application in organic synthesis. Bismuth exhibits two common oxidation states: Bi^{3+} and Bi^{5+}. The electron configuration of bismuth is [Xe] $4f^{14}5d^{10}6s^{2}6p^{3}$. This particular electron configuration allows bismuth(III) compounds to act as Lewis acids due to the lack of shielding of the outer electron shells. We have demonstrated the utility of some bismuth compounds in the synthesis of furans. They also serve as useful Lewis acid catalysts for epoxide rearrangements. The goal of this project is to investigate the utility of Bismuth compounds as Lewis Acids. If successful, these new methods should led to environmentally safe reagents for carrying out important transformations. A summary of these results will be presented.

Poster Presentation 3

BISMUTH (III) COMPOUNDS AS LEWIS ACIDS EPOXIDE REARRANGEMENTS USING BISMUTHYL PERCHLORATE

Jesse M. Blazek and Ram S. Mohan*
Department of Chemistry, Illinois Wesleyan University

The rearrangement of epoxides to carbonyl compounds has been carried out by a variety of Lewis Acids. Bismuth compounds are relatively inexpensive and non-toxic, making them attractive candidates for use as reagents in organic transformations. We wish to report that bismuthyl perchlorate ($BiOClO_4$) is an efficient catalyst for the rearrangement of epoxides to carbonyl compounds. The results of this study will be presented.

Poster Presentation 4

SYNTHESIS OF DIFUNCTIONAL AMINES AND SUBSEQUENT REACTION WITH THE HEXAMOLYBDATE ION: COMPONENTS FOR SUPRAMOLECULAR ARCHITECTURES

Jonathan T. Brockman and Rebecca Roesner*
Department of Chemistry, Illinois Wesleyan University

The practical limits of manufacturing smaller and smaller electronic components is fast approaching, and scientists have been exploring the use of molecular and macromolecular electronic devices. Supramolecular systems have been designed and demonstrated to function as molecular switches, molecular wires or photoelectric devices. One supramolecular structure is the rotaxane which is composed of a linear molecular string (linker) threaded through a macrocyclic molecular ring with bulky blocking groups attached to the ends of the linker to prevent dethreading. Two possible routes to the synthesis of difunctional amine linkers have been compared.[1,2] Aspects of both procedures were combined to obtain highest purity (figure 1). Our current goal is reaction of one of the resultant difunctional amines with two equivalents of tetrabutylammonium hexamolybdate(VI) (figure 2).

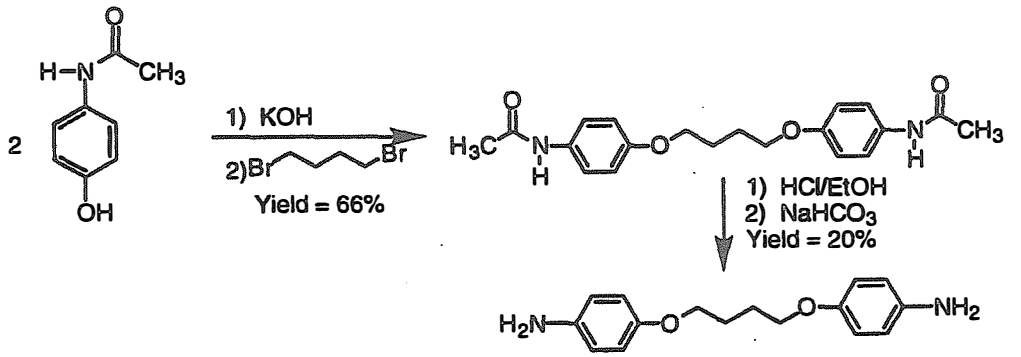


Figure 1

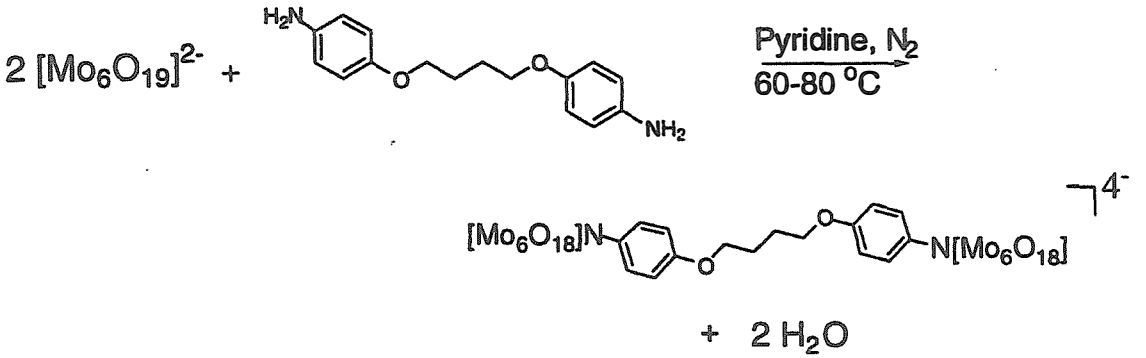


Figure 2

[1]Bartulin, J.; Ramos, M. L.; Rivas, B. L. *Polymer Bulletin* 1986, 15, 405-409.
[2]Griffin, Anselm C.; Britt, Thomas R.; Hung, Robert S. L.; Steele, Marcus L. *Mol. Cryst. Liq. Cryst.* 1984, 105, 305-314.

Poster Presentation 5

STUDIES TOWARD THE TOTAL SYNTHESIS OF AN ORGANOPHOSPHORUS ANALOG OF ACETYLCHOLINE

Christopher R. Butler and Jeffrey A. Frick*
Department of Chemistry, Illinois Wesleyan University

Acetylcholine is a vital neurotransmitter in the human nervous system. It functions in both the cardiac and smooth muscle synapses as well as the neuromuscular skeletal joints. The release of acetylcholine in the muscle cells stimulates the muscle to contraction. The acetylcholine must therefore be broken down quickly following its release to prevent continued contraction which would certainly result in death. Acetylcholine is broken down by the enzyme acetylcholinesterase, (AchE), via a hydrolysis mechanism. This mechanism is somewhat unclear in the involuntary muscles of the human body, and proposed mechanisms have been strongly debated. Organophosphorus (OP) compounds have been used throughout much of the study of the AchE mechanism as inhibitors of the enzyme. The total synthesis of a conformationally constrained OP analog of acetylcholine, combined with enzyme assays with such an analog, would demonstrate further the interaction between the OP inhibitors and AchE, as well as provide greater insight into the mechanism of the acetylcholine hydrolysis. We present a synthetic strategy for this compound and our progress on the synthesis of a model compound.

Poster Presentation 6

THE DISCOVERY APPROACH TO ORGANIC CHEMISTRY THE SYNTHESIS OF ACID SENSITIVE EPOXIDES

Rebecca S. Centko and Ram S. Mohan*
Department of Chemistry, Illinois Wesleyan University

The majority of organic chemistry lab experiments currently used are "cookbook" in nature, and do not encourage critical thinking skills. We have developed a discovery-oriented lab that encourages critical thinking and also exposes the student to state-of-the-art instrumentation. The reaction of trans -anethole with mCPBA has been carried out both in the presence and absence of a buffer. Students are required to analyze the product obtained under each condition using NMR and IR spectroscopy and GC-MS. Apart from the use of state-of-the-art instruments, the experiment requires detailed analysis of the experimental results.

Poster Presentation 7

VOLUNTARY VERSUS INVOLUNTARY RUNAWAYS: BASIC DEMOGRAPHICS AND CHARACTERISTICS

Darcia A. Colburn and Doran French*
Department of Psychology, Illinois Wesleyan University

The concern for runaway youth is not a recent concept, but there is a new concern that youths are leaving home earlier than ever. According the to the National Network for Youth, 38% of runaways are under the age of 14 (Isaacs, 1997). Clinicians, as well as researchers, who have worked with the population of runaway youth recognize that there are two distinct groups (i.e., voluntary and involuntary). Previous research has neglected the difference between those youths who have left home on their own initiative (voluntary) and those youths who were forced to leave their home (involuntary). I hypothesized that involuntary youth will predominantly male and older in age. I examined a number of variables to assess if there are differences between these two groups of runaways. The major difference that emerged was that involuntary females had a significantly higher incidence of crime, especially violent crimes, than voluntary female runaways.

Poster Presentation 8

HOLOGRAM FABRICATION FOR ASSEMBLING NANOCOMPOSITE MATERIALS

Matthew T. Dearing, Gabriel C. Spalding*, Eric Dufresne[†], and David Grier[†]
Department of Physics, Illinois Wesleyan University
[†]Department of Physics, University of Chicago

We have developed a technique which uses laser light to assemble large numbers of micro-particles in a highly-controllable way. Here, we discuss the mechanisms behind our use of visible light to levitate and translate physical objects. This technology, called optical tweezing, has existed for over a decade – but has previously been limited to trapping one or two particles at a time. Our addition of holographic techniques has extended these capabilities significantly, allowing for the simultaneous manipulation of large numbers of colloidal particles into any (user-defined) configuration.

We have successfully demonstrated the complete implementation of holographic optical tweezers. We can digitize any image and convert it to a "calculated hologram" via an algorithm of iterative approximation. We then fabricate a transmission hologram which is a physical manifestation of this calculation. In our optical apparatus, the holographic image is then transformed into an array of optical tweezers which trap colloid into the desired structure. So far as we know, the method we have developed is the only means of *fully configuring* the assembly of particles in solution. Applications are envisioned in many different disciplines including biology and chemistry.

Poster Presentation 9

CALORIC CONTENT AND UNIT PRICE THEORY

Sara J. Estle, Heather A. Hunnell, James D. Dougan*
Department of Psychology, Illinois Wesleyan University

Behavioral economics has been an important approach in behavior analysis for over 20 years, and the law of supply and demand has often been of particular interest. According to the law of supply and demand, there should be an inverse relationship between the price of a commodity and the consumption of that commodity. Typically, this is simulated in the laboratory using Fixed Ratio (FR) schedules, in which the rat must press a lever a fixed number of times (the FR requirement) in order to obtain the reinforcer. The number of reinforcers earned is a measure of "consumption." The relationship between price and consumption is known as a demand function, and the slope of that function is known as elasticity. Recent theories have argued ***unit price*** is a critical variable in determining elasticity. Unit price is calculated by considering both the price of the reinforcer (the FR requirement) and the size of the reinforcer (for example, the drug dose or the number of food pellets). A schedule providing 1 pellet on an FR 10 schedule would thus have the same unit price as a schedule providing 2 pellets on an FR 20 schedule. According to Unit Price theory, demand functions for a particular reinforcer should be identical when consumption is plotted in terms of unit price. Recent evidence from our laboratory, however, has failed to support unit price theory when rats responded in an open economy. Schedules providing two food pellets for high FR requirements were more elastic than schedules providing one food pellet for low FR requirements. One reason for this failure may be that rats are less sensitive to the magnitude of reinforcement than to the rate of reinforcement. It is possible that other dimensions of reinforcer magnitude (such as "caloric content") might produce a different effect. In our most recent studies, six rats pressed bars for condensed milk in an open economy. On one FR series, the rats were required to complete a small FR requirement to receive a diluted milk solution. On a second series, the rats were required to complete an FR requirement double that used in the previous FR series, but received a reinforcer with twice the concentration. The results have implications for behavioral economics in general and unit price theory in particular.

Poster Presentation 10

A SURVEY OF ORGANOCHLORINE PESTICIDE CONTAMINATION IN COSTA RICAN TAXA

Mark Wieland and R. Given Harper* and Jeffrey Frick*
Department of Biology, Illinois Wesleyan University

Amphibians, turtles, and rodents collected from a conservation area in Northwestern Costa Rica were analyzed for organochlorine (OC) pesticide contamination. Pesticides had not been used in this area for at least thirty years. Six of thirty-nine amphibians, three of six turtles, and one of eight rodents contained pesticides ranging from 12.96 ng/g to 277.70 ng/g. The average body mass of contaminated animals was 163.54 g, compared to 61.00 g for uncontaminated animals, suggesting that bioaccumulation of these compounds occurs in organisms from higher trophic levels. The presence of OCs in taxa from the conservation area indicates the possibility of long-distance transport of pesticides through the atmosphere, and these pesticides may be a contributing factor to the documented population declines of Central American amphibians and reptiles.

Poster Presentation 11

LONELINESS AND COPING: EXAMINING THE PREDICTORS OF SOCIAL AND EMOTIONAL LONELINESS

Betsy Garver and John Ernst*
Department of Psychology, Illinois Wesleyan University

This study sought to extend research on loneliness and coping. Emotional loneliness is a state that results from the lack of a personal, intimate attachment with another person, and social loneliness results from the lack of engaging in a social network, in which a person shares common interests with a group. Active coping involves making a plan and following it, while passive coping involves using passive techniques such as self-blame or distancing to solve the problem.

In addition to replicating the prior finding of Russell et al. (1984) that emotionally lonely individuals are more likely to actively cope with their loneliness than socially lonely individuals, who are more likely to passively cope with their loneliness, we examined potential mediators of this relationship: cognitive appraisal, self-concept clarity, and confidence in social skills. 42 college students involved in long distance relationships (a total of 50 is expected to participate in the study) were given questionnaires measuring emotional vs. social loneliness, coping styles, levels of self-esteem, confidence in social skills, self-concept clarity, and cognitive appraisal. Students in long distance relationships were chosen for the study because social and emotional loneliness were expected to be fulfilled by different sources and could be easily differentiated. Statistical analysis is in process to test the hypothesis that emotionally lonely people are more active copers than socially lonely people and whether cognitive appraisal, self-concept clarity, and confidence in social skills are mediators of this relationship.

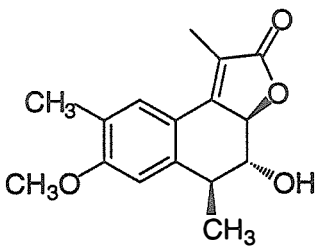
Poster Presentation 12

SYNTHESIS OF THE NOVEL SESQUITERPENE LACTONES HERITIANIN, VALLAPIN, AND VALLAPIANIN: POTENTIAL BIODEGRADABLE PESTICIDES

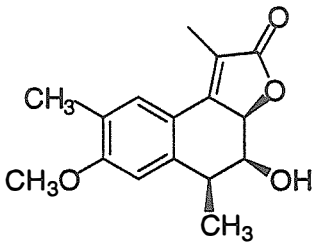
Kostas Gavardinas and Ram S. Mohan*
Department of Chemistry, Illinois Wesleyan University

For decades considerable research has focused on improving the efficiency of crop protection. The increased resistance of pests to the currently available pesticides has made the development of newer pesticides even more urgent. Many naturally occurring biodegradable compounds have often been used as pesticides and with increased environmental concerns, the identification of biologically active natural products has attracted significant attention. Fish toxicity has often been used as a measure of pesticidal activity. Several Southeast Asian mangrove species have been shown to possess ichthyotoxic properties. A bioassay of the extracts obtained from Heritiera littoralis, a Philippine mangrove plant, indicated toxicity toward fish thus suggests the possibility of their use as pesticides. Three sesquiterpene lactones, Heritianin, Vallapin, and Vallapianin have been isolated from H. littoralis. Vallapin, in particular, showed activity against the cotton boll weevils.

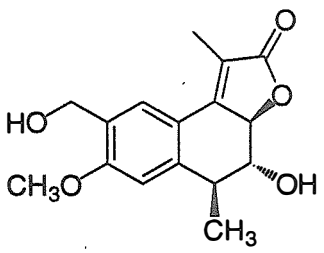
The three lactones contain a novel sesquiterpene skeleton of the cadinane class with an unusual oxygenation pattern and their synthesis should lead to newer synthetic methodology as well. A proposed synthesis of the three compounds as well as progress to date will be discussed.



Heritianin



Vallapin



Vallapianin

Poster Presentation 13

MORPHOLOGY OF THE HEART IN LARVACEANS (APPENDICULARIA: OIKOPLEURIDAE)

Ernest Hixon and Elizabeth Balser*
Department of Biology, Illinois Wesleyan University

Larvaceans are small Urochordate animals that in many ways resemble the tadpole larva of other Urochordate animals, in particular those of the sea squirts. The larvaceans have a relatively large head region containing almost all of the animal's organs, and a long, flat muscular tail. A mucous house is secreted around the larvaceans head to allow for filter feeding. Existing morphological descriptions of the Oikopleuridae heart are both limited in information and incomplete. In this study we offer a new morphological description of the larvacean heart and its associated structures. Analysis of the heart was done by viewing sections of larvaceans using both light and electron microscopes, as well as analysis of video recordings of live animals. The heart appears to be a simple contractile coelomic cavity resting between the intestine and the left lobe of the stomach. An interesting and unreported aspect of the heart is that an extension of the heart coelom extends a short distance into the tail. Contractions of the heart are rapid and seem to lack directionality. The morphology of the heart is useful in defining phylogenetic relationships within the Urochordates, a subphylum within the Chordata. Two hypotheses attempt to explain the relationship between larvaceans and sea squirts. The first is that larvaceans are primitive relative to the sea squirts, and the other that larvaceans are more derived than sea squirts. The morphology of the heart of the larvacean is simpler in design than that of sea squirts and more closely resembles that of two out-groups to chordates, the Echinodermata and the Hemichordata. This evidence, in conjunction with other morphological characteristics supports the hypothesis that larvaceans evolved from a common ancestor of both groups prior to the appearance of sea squirts.

Poster Presentation 14

THE EFFECT OF TECHNOLOGY GROWTH ON MONEY SUPPLY AND DEMAND: A COINTEGRATION APPROACH

Patrick Holly, Jr. and Carolyn Stumph*
Department of Economics, Illinois Wesleyan University

The 1990's have been a prosperous decade economically, characterized by notable surges in technological innovation and adaptation. Certain economic historians, Mokyr in particular, believe we are experiencing growth that is parallel to that of the Industrial Revolution, which places late 20th century America at the forefront of a new "Technological Revolution." (1996). Only time will dictate the accuracy of that designation. However, there is no doubt that substantial technological development has had a profound impact on U.S. economic evolution over the last 10-15 years. More specifically, significant technology growth has placed the nation's monetary structure at a dynamic crossroads. New purchase and payment methods have developed that are eclipsing older, more paper based forms

The purpose of this paper is to analyze the significance of the effects current payment technologies have had on money supply and demand. Specific attention will be given to M1 and M2 stocks, M1 and M2 velocities, the Fed Funds Rate and National Income, and how their interaction with each other has been affected by technology expansion. Using the 1980 ATM and EFT debut as a proxy for current technological development in a cointegration test model, it is hypothesized that current payment technologies have allowed for a more cohesive interaction between these variables through a reduction in transaction costs.

Poster Presentation 15

THE DETERMINANTS OF HOME OWNERSHIP: AN APPLICATION OF THE HUMAN CAPITAL INVESTMENT THEORY TO THE HOME OWNERSHIP DECISION

Jaclyn Hood and Michael Seeborg*
Department of Economics, Illinois Wesleyan University

Over the past years, the vast changes in the economy and society have called for the reevaluation of the determinants of home ownership. The purpose of this study is to determine the factors of home ownership using a logistic regression. This paper differs from past research in that it applies human capital investment theory to the home ownership decision. Using a sample of young adults from the National Longitudinal Survey of Youth, I found that the main determinants of home ownership are race, gender, educational attainment, age, marital status and net family income. These results are consistent with the findings of previous literature. The major contribution of this study is the refinement of the relationship between family size and home ownership. I found that the probability of home ownership increases as family size increases up to a certain level at which the probability decreases as family size continues to increase.

Poster Presentation 16

SPECIFIC WORRIES OF CHILDREN WITH SIBLINGS WHO HAVE SPECIAL NEEDS: A COMPARISON BETWEEN DOWN SYNDROME AND TYPICAL DEVELOPMENT

Laura M. Holsen and Dr. Linda Kunce *
Department of Psychology, Illinois Wesleyan University

In this exploratory study, 12 children with siblings with Down syndrome and 12 children with typically developing siblings were interviewed about general anxiety and specific worries concerning their sibling. Parents completed parallel measures regarding the child participant's anxieties as well as a general measure of child behavior. Data were analyzed to determine whether siblings of children with Down syndrome have more specific worries and heightened general anxiety as compared to controls. Differences between siblings as a function of age and gender were also investigated. Implications of the study include validity testing of the sibling worries measure and clinical evaluation of the children's use of support systems and need for relevant information about their siblings.

Poster Presentation 17

TECHNIQUES IN BIOLOGICAL ILLUSTRATION

Rebecca Kirk and Elizabeth Balser*
Department of Biology, Illinois Wesleyan University

From the very first cave paintings of the Paleolithic Era humankind has sought to express with images the knowledge of prey items, hunting techniques, medicinal plants, and life experiences. This tradition of visual illustration became a natural complement to advances in sciences and during the Renaissance and the Enlightenment periods significant developments in the printing process improved the application of illustration to manuscripts of scientific advancements. In modern times, as an art and a science, Scientific Illustration continues to play a fundamental role in translating complex verbal descriptions into a condensed more cognizant form that is also attractive to the reader.

Scientific Illustration is a mode of communicating information and thus it is critical that the technique for each representation most accurately portrays the biological subject. The diversity of techniques possible for scientific illustrations provides unique and specialized results, however, for the most accurate rendering of a subject, the limitations and capabilities of different techniques must be understood. Issues to consider when preparing an illustration include size, the printing process to be used for publication, and the limitations of the media.

Several of the techniques to be presented are watercolor, pen and ink, gouache, scratchboard, and continuous wash. Pen and ink is the most widely used medium. With the myriad of strokes possible by the pen, the line becomes the essential component of creating textures from smooth wet surfaces to rough bristled fur. Similarly, the possibilities are endless when coupled with wet or dry techniques or the addition of rubbing alcohol or salt granules. These techniques enhance the illustrator's primary goal which is to render natural subjects in the most realistic and accurate representation possible.

Poster Presentation 18

PHYLUM CTENOPHORA: THE MORPHOLOGY OF THE CILIATED ROSETTE CELL

Danielle Knod and Elizabeth Balser*
Department of Biology, Illinois Wesleyan University

Comb jellies or ctenophores are delicate, trasnsparent animals characterized by eight meridional rows of cilia. Ctenophores are for the most part pelagic animals with a few benthic species (Ruppert and Barnes 1994). These animals have two main body cavities, the gastrovascular system (gvs) and the mesoglea. The gvs is a series of canals in which digestion of food and circulation of nutrients and water occurs. The mesoglea is a connective tissue compartment situated between the gvs and the outer epidermis. The only known connection between these two compartments is provided by specialized cells called the ciliated rosette cells. The rosette cells form a canal that opens between the gvs and the mesoglea (Hernandez-Nicaise 1991).

With the exception of the work of Hernandez-Nicaise (1991), little is kown about the structure of these cells in adults, and published accounts of the cells in larvae are lacking. The work presented here describes the morphology of the rosette cell in cydippids, the planktonic larvae of ctenophores. As in adults, the rosette cells in larvae are located on the meridional canals of the gvs. Two ciliated cells form a pair of superimposed rings lining each side of the aperture. The cilia are arranged in a conical tuft and beat synchronously with each other into the center of the canal created by the two rings (Hyman 1940).

The function of the rosette cell is unknown; however, Hyman (1940) proposes that they function to regulate water balance in the mesoglea. Although a selective excretory filter has not been identified, an alternative hypothesis of the function of the rosette cells is excretion of water and metabolites from the mesoglea into the gastrovascular system.

Poster Presentation 19

BIRD SPECIES DIVERSITY ALONG A SUCCESSIONAL GRADIENT IN A COSTA RICAN CLOUD FOREST

Alexandra Latham and Karen Masters*, Instituto de Monteverde, Costa Rica
Department of Biology, Illinois Wesleyan University

Bird species diversity differs from habitat to habitat, and a number of methods have been employed to explore the reasons for the variations. The purpose of this study was to document bird species diversity in four study sites of different stages of succession. The hypothesis was that highest bird species diversity would be found in the most structurally complex habitat. A detailed census of life forms, canopy height, DBH's, and bird species was conducted during November, 1998. The average number of life forms, the mean total abundance of life forms, percent ground cover, canopy height, DBH size classes, and bird diversity were all found to vary significantly from site to site. A positive correlation was found between the successional stage and bird species diversity. Canopy height, life form variety, and habitat heterogeneity seemed to have the biggest effect on bird diversity. These results have implications for various conservation practices, specifically those involving land being maintained as secondary growth.

Poster Presentation 20

NEW SPECIES OF THE TARDIGRADE, *MILNESIUM*, DISCOVERED ON ROOF TOP IN CENTRAL ILLINOIS

Karen Lindahl and Elizabeth Balser*
Department of Biology, Illinois Wesleyan University

Commonly referred to as one of the lesser-known phyla of invertebrates, Tardigrada is a group of organisms that can be characterized as microscopic aquatic or semi-aquatic animals. All have four pairs of bilobed legs, a sucking pharyngeal bulb and. the ability to go into a hibernation like state called cryptobiosis. Tardigrades can live in marine or freshwater aquatic environments or in limno-terrestrial environments such as mosses and lichens. The ability of tardigrades to suspend their metabolism and enter a cryptobiotic state when environmental conditions are not favorable, has enabled these animals to survive in a variable environment. Multiple specimens of eutardigrades were collected from lichens and mosses taken from the roof top of a house in Bloomington, IL. Specimens were examined using both light and scanning electron microscopy in order to establish species' identification. Detailed analysis of morphological characteristics was completed for each specimen of *Milnesium.* Based on comparisons with descriptions of known species of the genus *Milnesium* a new species has been recognized. To date only one species of this genus has been reported for central Illinois and the United States. This new species is distinguished by a distinct three branched and two branched claw on each leg. Point ratios, comparative measurements of multiple aspects of the buccal apparatus, are also provided in order to establish a more precise description of the species in this genus.

Poster Presentation 21

FROM BROWNIAN MOTION TO STOCKS AND FUTURES: A HISTORICAL LOOK AT THE DEVELOPMENT OF STOCHASTIC CALCULUS

Jerome C. Majewski and Narendra K. Jaggi*
Department of Physics, Illinois Wesleyan University

Einstein had shown in 1905 that the random "Brownian movement" first witnessed by Robert Brown in 1828 could be explained by the kinetic molecular theory[1]. Almost twenty years later, mathematician Norbert Wiener explained "the mathematical properties of the curve followed by a single particle" exhibiting Brownian motion by characterizing the dynamics as a mathematical stochastic process[2]. His work in turn introduced a new area of probability theory now referred to as stochastic integration. In the following decades, most mathematical physicists seem to have become occupied with the exciting developments of quantum mechanics. However, the 1973 papers of Black, Scholes[3], and Merton[4] regarding the pricing of risky assets revived interest in stochastic integration, resulting in the pursuit of many applications for stochastic calculus. This poster will present the history, growth, and future of stochastic calculus and its apparent links with Physics and Economics.

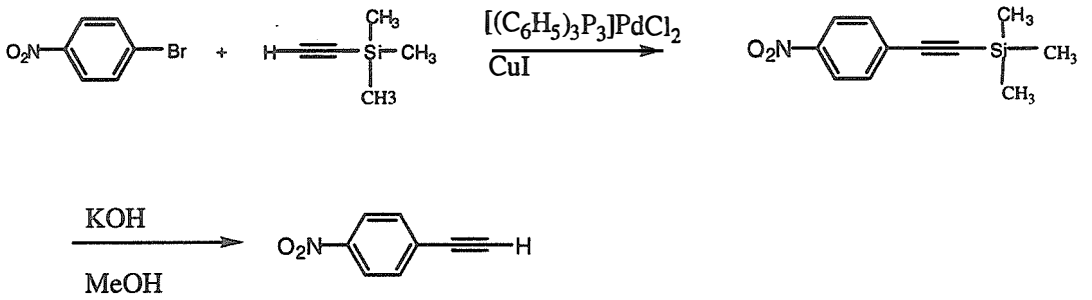
[1]Einstein, Albert. Investigations on the theory of Brownian movement. New York: Dover Publications, 1956. 86-7.
[2]Masani, Paul R. Norbert Wiener. Boston: Birkhäuser Verlag Basel, 1990. 83-6.
[3]Black, Fischer, and Myron Scholes, "The pricing of options and corporate liabilities." Journal of Political Economy 81 (1973): 637-654.
[4]Merton, Robert. "Theory of rational option pricing." Bell Journal of Economics and Management Science 4 (1973): 141-183.

Poster Presentation 22

SYNTHESIS OF 1,4-BIS (4-AMINOPHENYL)-1,3-BUTADIYENE AS A LINKER FOR HEXAMOLYBDATE STOPPERED ROTAXANES

James L. Martello and Rebecca Roesner*
Department of Chemistry, Illinois Wesleyan University

This project is aimed at the synthesis of 1,4-Bis(4-aminophenyl)-1,3-butadiyene as a linker for rotaxanes. A rotaxane consists of a long chain, the linker, threaded through a ring molecule and blocked on either end by a bulky ion or "stopper". The first step in the synthesis was the reaction of trimethylsilyl acetylene with p-bromo-nitrobenzene[1]. The resulting p-nitrotrimethylsilylethynylbenzene was purified by column chromatography. The silyl protecting groups were then removed and the resulting p-nitroethynylbenzene was purified by column chromatography[1] followed by recrystallization from hexane. Attempts were made to join two equivalents of the product together at the acetylenic carbons forming a long straight chain[2]. Future plans include catalytic reduction of the nitro groups to amine groups and subsequent attachment of the linker to two hexamolybdate ions.



[1]S. Takahashi, Y. Kurotama, K. Sonogashira, N. Hagihara. *Communications* 627-630 (Aug 1980)

[2]G. Eglinton, W. McCrae. The Coupling of Acetylenic Compounds. 311

Poster Presentation 23

X-RAY SPECTROSCOPIC OBSERVATIONS OF A METAL-POOR GLOBULAR CLUSTER X-RAY BINARY SYSTEM

Daniel N. Mateja and Cynthia Hess*
Department of Physics, Illinois Wesleyan University

X2127+119 is a low-mass X-ray binary (bright neutron star - normal star system) in NGC7078, a metal-poor globular cluster of stars located 10 kpc (3 * 10^22 cm) away, just outside of the Milky Way Galaxy. X2127+119 is the brightest X-ray source in the globular cluster, and it coincides with a dim optical star, AC211. This low-mass X-ray binary exhibits extremely bright X-ray bursts and has a possible corona surrounding the disk of matter accreting onto the neutron stars surface. Spectroscopic observations, which measure brightness as a function of energy, offer insight into the conditions in the X-ray emitting gas. To date the best spectroscopic observatory is the Advanced Satellite for Cosmology and Astrophysics (ASCA), a joint Japanese-U.S. mission. In preparation for study of higher-resolution spectra from the Chandra X-ray Observatory (Advanced X-ray Astrophysics Facility), we examined the ASCA observations of X2127+119 from 1995. We fit the continuum, identified discrete emission lines and the ions which produce them, and tested two possible modes for the heating mechanism, in order to probe the temperature, density, ionization level, and geometry of the line emitting gas.

Poster Presentation 24

MANAGING FAMILY VIOLENCE ISSUES IN THE PUBLIC SCHOOLS: PERCEPTIONS OF SCHOOL PERSONNEL

Natalia K. Migal, Jaclyn K. Hood, and James Sikora*
Department of Sociology, Illinois Wesleyan University

There has been growing awareness concerning the management of family violence issues in the public school systems. The purpose of this project was to determine: 1) the knowledge of school personnel about family violence, 2) the current procedures in the schools for reporting and assisting with family violence concerns, and 3) the support available for students involved in family violence situations. Therefore, in cooperation with the School/Education Committee of the Family Violence Prevention Council (11th Judicial Circuit), a questionnaire was developed to survey school personnel in two counties as to their knowledge regarding these concerns. Results indicate that school faculty and staff need education in recognizing family violence and assistance in developing a procedure for reporting and dealing with these situations. The counties involved are now planning programs to address these issues.

Poster Presentation 25

ANALYSIS OF ARCHIVED X-RAY OBSERVATIONS OF A GALACTIC X-RAY BINARY

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The low mass X-ray binary, a neutron star-normal star system, 4U 0614+09 is identified with a faint blue optical counterpart. It is located in the galactic plane at a distance of 4 kpc and is known to be an X-ray burster, emitting X-rays at a constant low level interspersed with occasional powerful bursts. The X-ray source 4U 0614+09 has a higher than average metallicity relative to other low mass X-ray binaries. Spectroscopic X-ray observations from the Advanced Satellite for Cosmology and Astrophysics (ASCA) were obtained from NASA archives. ASCA was launched by Japan on February 20, 1993, and is still operational today. Observations of 4U 0614+09 were carried out early in 1993 during the performance verification (PV) phase of the instrument. The detectors carried by ASCA, two CCD cameras called the Solid-state Imaging Spectrometers (SIS) and two Gas Imaging Spectrometers (GIS), both have excellent energy and spatial resolution. The data collected from 4U 0614+09 are of varying quality and have never been published. In order to probe some of the physical properties and geometric information of the X-ray emitting gas, a spectroscopic analysis of the best PV phase data was performed. The continuum was fit using an X-ray spectral fitting package called XSPEC. Discrete line features of the spectrum were identified to determine which ion species are present in the source. Two models of heating mechanisms, collisional and photoionization, were then tested to investigate the temperature, density, and geometry of the line-emitting gas.

Poster Presentation 26

NEW REAGENTS FOR ORGANIC SYNTHESIS THE ERLENMEYER AZLACTONE SYNTHESIS CATALYZED BY BISMUTH COMPOUNDS

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Azlactones are anhydrides of N-acylamino acids and are useful precursors to substituted amino acids. The Erlenmeyer Azlactone Synthesis involves the condensation of an aldehyde with an acylglycine in the presence of acetic anhydride and sodium acetate. We have demonstrated that Bismuth (III) acetate is an efficient catalyst for the Erlenmeyer azlactone synthesis. The low toxicity of Bismuth (III) compounds make them attractive as catalysts for this condensation reaction. The reaction can be carried out with a variety of aromatic aldehydes in good yields.

Poster Presentation 27

SCALING OF ORGANIC WEIGHT AND ENERGY CONTENT OF ARTHROPOD EGGS

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Among echinoderm species the average energy content (EC) and organic weight (OW) of eggs scale in direct proportion with average egg volume (Jaeckle, 1995). The scaling of OW and EC was evaluated for decapod crustacean and arachnid arthropods (26 species) using average values taken from the literature. This data set includes taxa that exhibit a variety of life history strategies and are found in aquatic, marine, and terrestrial habitats. Egg OW (exponent = 1.06, r^2 = 0.96, 11 species) and egg EC (exponent = 1.07, r^2 = 0.94, 7 species) of crustacean species scale in direct proportion with egg volume. The EC of eggs of crustacean (8 species) and arachnid (12 species) arthropods scales directly proportional to egg OW (crustacean exponent = 1.03, r^2 = 1.00; arachnid exponent = 1.01, r^2 = 0.99); the Y-intercepts are not significantly different. The weight-specific energy content of eggs are not different between groups (combined average = 0.027 ± 0.0028 mJ/μg, range = 0.017-0.031, 20 species). Thus, eggs of these species are energetically equivalent suggesting that for any given egg volume the weight-specific energy content is optimized.

Poster Presentation 28

THERMAL CONDUCTIVITY OF A SYSTEM DOMINATED BY QUANTUM FLUCTUATIONS

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The Nobel Laureate Alex Miller has established that quantum fluctuations play a dominant role in the electrostatic response of strontium titanate at low temperatures.[1] A recent investigation of its electrostrictive response at low temperatures (by Grupp, et al.[2]) seemed to indicate the presence of a quantum phase transition, because the change in shape appeared to diverge according to a power law as T -> 0. (This would not be a thermodynamic phase transition but a phase transition driven by quantum fluctuations). However, similar measurements by W.W. Huber, et al.[3] instead suggest that the electro mechanical response of strontium titanate is independent of temperature below 15K, and that the results reported by Grupp may have been affected by a dependence of the thermal conductivity on applied electric field.

During the past few years anomalies in the behavior of strontium titanate at low temperatures have been observed, which do not coincide with the previously offered explanation of the strong influence of electric field on the thermal conductivity of this material

Since the questions surrounding Grupp's results require further investigation and because the role of quantum fluctuations in this material remains of strong interest, we have undertaken a study of the thermal conductivity of strontium titanate as a function of temperature, applied electric field, and orientation of the applied electric field with respect to the crystal axes. The literature contains a partial set of these measurements [4], which our work is intended to complement.

[1]K. A. Miller, H. Burkard, Phys. Rev. B 19, 3593 (1979).
[2]Daniel E. Grupp and Allen M. Goldman, Phys. Rev. Lett. 78, 3511 (1997).
[3]W.W. Huber, Ph.D. thesis, University of Minnesota (1999) - unpublished.
[4]E. F. Steigmeier, Phys. Rev. 168, 523 (1968).

Poster Presentation 29

ADULTS WITH ATTENTION DEFICIT/HYPERACTIVITY DISORDER: AN EXAMINATION OF THE EFFECTS OF EXTRA-TASK STIMULATION ON ATTENTION AND COMPREHENSION DURING READING

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Although much research has been done on children with Attention Deficit Hyperactivity Disorder (ADHD), there is little literature on adults with the disorder. It was previously thought that ADHD went into remission with age, but recent findings suggest that as many as 80% of children diagnosed with ADHD continue to express symptoms as adults.

One of the biggest problems faced by those afflicted with ADHD is the comprehension of information. Competing distractions, including random thoughts, make it difficult to stay on task. In children, however, it has been found that musical stimulation has a positive effect on their ability to complete more arithmetic problems correctly (Abikoff et al., 1996). These results support the underarousal/optimal stimulation theory proposed by Zentall (1975, 1993). This theory states that a person with ADHD is under-aroused in the frontal lobe of their brain, which is the center for attention. Listening to music may stimulate this area and brings his/her attention level up to normal. I am proposing that musical stimulation may also help adults who suffer from attention disorders to concentrate.

The present study examined both students diagnosed with ADHD and undiagnosed students. All participants were given a battery of tests to assess general intelligence, frontal lobe functioning, and symptoms of inattention. The Brown Attention Deficit Disorder Scale was used to rate students on tendency toward attention deficits. Participants were placed in one of three groups based on their Brown score: low, medium, or high. Participants were given three passages to read and study with the knowledge that they would later be tested on their comprehension. Each passage was studied separately under one of three conditions; silence, speech, and music. Music was played from a favorite CD brought in by the participant. Both score on the comprehension questions and time taken to read the passage will be examined under each stimulatory condition and participant type.

Given the underarousal/optimal stimulation theory, it is hypothesized that a significant difference in scores of comprehension will result between the silent condition and musical preference condition of the participants with a high tendency toward or diagnosis of ADHD. It is expected that the reading comprehension scores will be significantly higher when learning is done with music of preference, since the participants are more aroused and better able to concentrate. A smaller, non-significant change in the scores of participants with a low tendency toward ADHD is also hypothesized. Analyzed data will be presented at the conference.

Poster Presentation 30

RESPONSES TO DIFFERENTIAL LIGHT WAVELENGTHS IN THE CELLULAR SLIME MOLD DICTYOSTELIUM PURPUREUM

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Cellular slime molds are detritus and soil inhabitants found predominately in dark, moist, forested regions. The unique life cycle of these organisms begins with spore germination with each spore releasing a single amoeboid cell called a myxamoeba. Myxamoeba feed by phagocytosis, then grow and divide to produce large populations of cells. Given proper chemical cues involving cAMP, myxamoeba aggregate into one or more large, motile pseudoplasmodium. After a variable period of migration, each pseudoplasmodium will stop and form a stalked fruiting body called a sorocarp. The sorocarp functions to disperse the spores that will release myxamoeba. Beginning in the multicellular pseudoplasmodial stage and culminating in the sorocarp stage, only two types of cells differentiate, stalk and spore cells, in the lifecycle of these organisms.

Due to the morphological simplicity of cellular slime molds, research scientists are using these organisms as model for scientific study. Research has been conducted studying processes of cell-cell communication, cell differentiation in the two cell type system, and behavioral processes such as myxamoeba aggregation, pseudoplasmodial migration, and sorocarp formation. A major focus of the work on behavioral processes has focused on when pseudoplasmodia stop movement and differentiate into the fruiting body. The results of this research have thus far determined that increased humidity, increased temperature, and light play significant roles in eliciting sorocarp formation. Light is known to signal more rapid induction of differentiation into the sorocarp. Previous work done on a sister group to cellular slime molds, the Myxomycota or plasmodial slime molds, revealed that certain frequencies of visible light, specifically blue and green, were the most effective in inducing sorocarp formation. There is no published research indicating that a similar sensitivity to portions of the visible spectrum exists in cellular slime molds despite exhibiting similar responses to light. In an effort to study cellular slime mold responsiveness, I have isolated the cellular slime mold Dictyostelium purpureum from soil samples in Bloomington, Illinois. I have determined positive phototaxis in this species, as well as, higher numbers of sorocarps formed when exposed to a 12:12 light to dark period over all light or all dark. The objective of the research presented here is to examine potential effects of wavelengths of visible light on myxamoeba aggregation, migration of pseudoplasmodia, and sites of sorocarp formation.

Poster Presentation 31

THE GNU NEURAL NETWORK VISUALIZER (GNNV)

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The GNU Neural Network Visualizer (GNNV) is an undergraduate research software project currently being developed by the Shelley Research Group (part of the Illinois Wesleyan Intelligence Network on Knowledge - IWINK) which, in turn, is a part of the Cognitive Science Consortium.

GNNV visualizes a fully-connected feed-forward three-layer artificial neural network, which learns by utilizing an implementation of the Backpropagation Algorithm. Artificial neural networks are a paradigm for pattern recognition which uses as a point of departure the biological structures of neural pathways and learning through the strengthening and weakening of these neural paths. The artificial neural network used by GNNV, built upon source code by Dr. Jeff Shufelt of Carnegie Mellon University, accepts as input the pixel values of digital images, and produces output in the form of answering questions such as, "Is the person in this image smiling?" Artificial neural network learning in GNNV currently consists of face recognition, but is being expanded to be user-definable with the use of any image set (e.g., faces, letters, shapes, etc).

GNNV is designed to be an interactive teaching tool, for use both as a classroom demonstration, and an application for individual student use. Courses in which GNNV may be used include Cognitive Psychology (PSYC 212), Artificial Intelligence (CS 338), and Mind and World (PHIL 103).

GNNV is comprised of two primary components: the foundational artificial neural network backbone, and the graphical user interface. The former is designed to be non-context specific: meaning that this foundational code isn't limited either to pedagogical purposes or even visualization. The later is implemented using the GTK+ graphics toolkit. Both components strongly stress object-oriented programming techniques in their design and implementation. Further, GNNV has provided the researchers involved with experience in large scale software development and the many topics which that involves: software design, distribution of tasks, version control, and issues of human-computer interaction.

GNNV is distributed under the GNU General Public License, which provides that the original source code will always be freely available to the general public.

Poster Presentation 32

HAIL MARY: ZORAIDA'S SEARCH FOR A CHRISTIAN GODDESS

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In addition to captivating its readers with the exciting and inspirational adventures of an anachronistic yet good-intentioned knight, Miguel de Cervantes Saavedra's *Don Quixote de la Mancha* also presents us with certain important social and political issues of Spain's history. The conflict between the Christian culture and the Islamic culture is apparent throughout Cervantes' masterpiece, and the subject of religious conversion, be it forced or freely chosen, is also raised. The character Zoraida, a Moorish woman desiring to become a Christian, presents an interesting case study of this relationship between the two faiths. Although Zoraida seems to be simply moving from one patriarchal society to another, Cervantes, in reality, has created a female character in search of a powerful and admirable woman to worship. Within Catholicism, Zoraida, and many religious of the past and present, have found the Virgin Mary to be just this powerful woman, an encounter which has greatly influenced their manner of prayer and worship.

Poster Presentation 33

PRODUCTS OF THE PHOTOLYSIS OF NITROUS ACID IN A BENZENE MATRIX

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The photodegradation of nitrous acid in the troposphere is an initiation step in the formation of photochemical smog. NOx emissions from internal combustion engines react with atmospheric water vapor during sundown hours to form nitrous acid. Daytime sunlight cleaves nitrous acid into OH and NO radicals, which attack hydrocarbons emitted by industry to form the constituents of photochemical smog. In order to model this process, aqueous nitrous acid was extracted into a liquid benzene matrix to form a clear solution, which was photolyzed with 365 nm radiation. The photolysis generated a yellow liquid phase and a deep red precipitate. The liquid phase products have been identified by GC-MS and HPLC analysis as p-benzoquinone, phenol, nitrobenzene, o, m, and p-nitrophenol, 1,2, 1,3, and 1,4-dinitrobenzene, 2,4-dinitrophenol, biphenyl, and 2,3, and 4-nitrobiphenyl. The red precipitate is insoluble in benzene and ether but soluble in water, methanol and acetone. 13C-NMR spectroscopy has been inconclusive in identification of the red precipitate.

Poster Presentation 34

COMMENSURATE-INCOMMENSURATE TRANSITIONS IN COLLOIDAL CRYSTALS

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Colloidal crystals are aggregates of small particles in solution which have become periodically ordered in one-, two-, or three-dimensions. Such systems are small enough to be susceptible to Brownian motion and yet large enough to be studied by video microscopy. For this reason, they serve as model systems for studying crystallization. Moreover, when the particle size is comparable to the wavelength of light, these materials hold potential as optical filters and switches, and as photonic bandgap materials. Recently workers elsewhere[1] have attempted to nucleate such structures via sedimentation of particles onto a template (lithographically patterned substrate or container walls). In such situations, the presence of multiple length scales (e.g., multiple particle sizes and/or a mismatch between the scale of the particles and the period of the template) results in the development of defect structures in the aggregate. We have, at Illinois Wesleyan, developed new techniques allowing fine control over aggregation. Rather than using a physical substrate, we will create an ìoptical substrateî which will allow us to dynamically tune the length scales of the template. This experimental design is intended to aid our study of the transition from commensurate aggregation to what happens as the length scales slowly become incommensurate. Here, we describe the larger context supplied by the scientific literature on colloidal crystals as well as the design of our own experiment, including our efforts to establish a system for automated video microscopy and image.

[1]Dinsmore, et al., Phys. Rev. Lett. 80, 409 (1998).

Poster Presentation 35

SPECIFIC WORRIES OF SIBLINGS OF CHILDREN WITH SPECIAL NEEDS: A COMPARISON AMONG ATTENTION DEFICIT HYPER-ACTIVITY DISORDER, AUTISM, AND TYPICAL DEVELOPMENT

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The majority of the research on siblings of children with special needs has focused primarily on siblings of children with developmental disabilities. Little research has looked at the experience of having a sibling with Attention Deficit Hyperactivity Disorder (ADHD). The current study was designed to explore the specific worries of children with siblings who have ADHD. Preliminary findings from this study are presented in case study format. The worries of three siblings of children with ADHD are compared with the worries of three matched siblings of children with Autism and the worries of three matched siblings of children with typical development.

Poster Presentation 36

A MODEL OF LONELINESS BASED ON SELF-CONCEPT THEORY

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This study utilizes the Brewer and Gardner theory of self-concept and relates it to previous theories of loneliness. Approximately 80 participants were cued by stories (primes) to put them in a mind-frame that focused on one level of self. We expect to run an additional ten participants. The levels we chose were the collective and the interpersonal self; the participants may also have been part of a control condition. The collective self is the way in which an individual perceives their personality characteristics within a collective group. The interpersonal self is the way in which an individual perceives their personality characteristics within a dyadic relationship.

The participants were then administered the UCLA Loneliness Scale. Previous research has shown that this scale can measure three types of loneliness: isolation, connectedness, and belongingness. It is predicted that the type of loneliness experienced will vary with the relationship with which the participant was primed.

We are currently in the process of analyzing these data. A MANOVA will be used to determine if participants primed with a collective story will have significantly lower (less lonely) belongingness loneliness scores on the UCLA scale than the control group. A second MANOVA will be used to determine if participants primed with an interpersonal story will have significantly lower connectedness scores on the UCLA scale than the control group. In addition, participants were given an additional loneliness scale, a depression inventory scale, and a demographics form. These measures were used to determine if the results are covarying with factors other than loneliness. It is predicted that they will not be significantly correlated with measures of loneliness.

Poster Presentation 37

BASE-CATALYZED ELIMINATION REACTIONS OF 2-SUBSTITUTED CYCLOHEXYL SULFONATES

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E-2 elimination is a base-catalyzed reaction that involves a bimolecular transition state. The products of these reactions are influenced by the stereochemistry of the reactants used, stereoelectronic effects, and the type of base used. The literature provides several examples of experiments which are consistent with a concerted mechanism. We have undertaken a systematic investigation of elimination reactions of trans-2-methylcyclohexyl tosylate. The product(s) of the reaction under varying base ratios have been analyzed by ^{1}HNMR spectroscopy and GC. The mechanistic implications of these results will be discussed.

Poster Presentation 38

NEW REAGENTS FOR ORGANIC SYNTHESIS OXIDATIONS WITH BISMUTH REAGENTS

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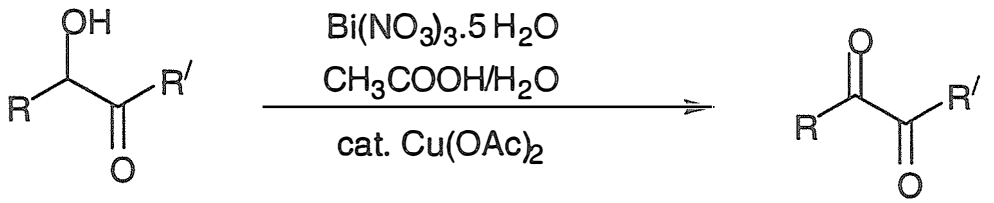
Oxidation reactions play an important role in synthetic organic chemistry. The most common oxidizing agents currently used are chromium metal based. These have the disadvantage of being highly toxic. Bismuth compounds are attractive candidates for use as reagents in organic synthesis due to their low cost and low toxicity. We wish to report that bismuth(III) nitrate pentahydrate oxidizes _-hydroxy ketones to _-diketones in high yields.



Poster Presentation 39

CARBON-BEARING IMPACTITES FROM THE GARDNOS IMPACT STRUCTURE, NORWAY: NO EVIDENCE FOR SOOT

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The Gardnos, Norway impact structure has a diameter of 4.5 km and is 400-900 Ma old. The structure has a carbon content of 0.1-1 wt%, 5-10x greater than those of exposed basement target rocks at Gardnos. The source of this high carbon concentration is still undetermined. Combustion of the impactor or carbon-bearing rocks might have occurred during the impact, producing carbon in the form of soot and charcoal. (Little combustible biomass existed on Earth at the time of the impact, 400-900 Ma ago.) To test this possibility, we searched for soot in a wide variety of Gardnos impactites and related rocks. We also analyzed post-impact crater-filling sediments and shales from distant localities that could have been present at the time of impact.

Dissolution and analysis procedures were based on those used for detecting soot from impact-produced wildfires at the Cretaceous-Tertiary (K/T) boundary. Reduced carbon was isolated using HCl and HCl/HF. Elemental carbon was separated from organic carbon by acidic dichromate oxidation. The elemental carbon was identified and characterized using SEM imaging and quantified by weighing and particle size analysis. Unlike K/T boundary rocks, many of these samples contained significant quantities of HF-resistant minerals which were in some cases left along with the desired elemental carbon following demineralization and oxidation. We corrected our post-oxidation carbon weights using SEM imaging and particle size analysis of carbon and mineral fractions. Soot contents were not considered significant unless the amount exceeded the estimated error.

After corrections were applied, none of the Gardnos impactites showed significant soot contents. Surprisingly, significant soot contents were found in three samples not directly related to the impact event, one from post-impact crater-filling sediments, and two from shale over 100 km east of the crater. The origin of the soot in these samples is not understood, and more research is in progress.