Graduate Research Review

2007–2008

LEHIGH UNIVERSITY

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Graduate Research Review 2007-2008

The *Graduate Research Review* was prepared under the supervision of the Graduate Student Senate.

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Editor's Letter

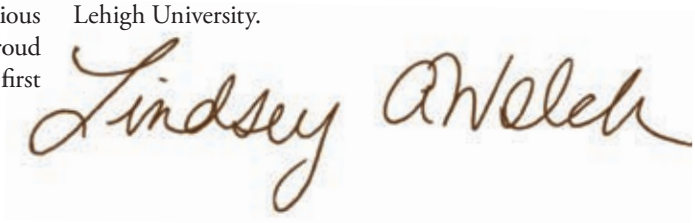
The Graduate Student Senate developed this project in the summer of 2007 to provide the graduate students of Lehigh University an opportunity to display their accomplishments in research. The audience for this project was primarily intended to be administration, prospective and current graduate students, as well as any other interested faculty and staff on campus. In addition to this audience, the project can definitely be a reference for other researchers outside of Lehigh University who may be interested in collaborations. Regardless, this publication will inform the research community of the caliber of research being performed on campus.

GRR Editor Lindsey A. Welch is a Ph.D. candidate in the Chemistry Dept. She is the newly elected secretary of the Graduate Student Senate for the 2008-2009 school year. Her hobbies include cooking, running, and playing soccer.

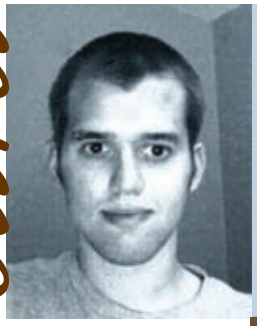
This year's inaugural issue of the GRR received near 100 submissions from various departments around campus. The GSS is proud to have this number of submissions in its first year. Hopefully with the success of this first publication, future years' issues will draw many more interesting abstracts. The qualifying submissions for the GRR include any abstracts of presentations by graduate students at conferences, meetings, or symposia occurring between March 1, 2007 and June 30, 2008.

Currently, graduate students attending and presenting their research at conferences and symposia have funding from the GSS in the form of travel grants. Due to a limited amount of funding, travel grants for graduate students are not always approved. In addition, the maximum amount of reimbursement offered rarely covers the full out-of-pocket costs graduate students encounter on these trips. The GSS hopes that the publication of the Graduate Research Review will motivate the Lehigh community to recognize graduate students for their significant contributions to research and offer support to attend meetings and strengthen this institution's reputation for quality research.

BD, a global medical technology company, offered a monetary award for the most intriguing abstract in the field of medical devices and biotechnology. The company also sponsored the project by providing us support to hold a celebratory reception upon the publication of the GRR. The printing was funded from the GSS budget. Sigma Xi, a scientific research society, also offered support for our project. The GSS hopes that in the future, other sponsors, either on or off campus, will support this wonderful project. The graduate student community seeks to establish a stronger presence on campus, and this publication is a step toward enhancing the graduate student experience at Lehigh University.



Editorial Board



Josh Britton is a first-year Ph.D. candidate in the History Department. He serves as the Unit Representative for History and American Studies in the Graduate Student Senate.

Marie E Maradeo is a Ph.D. candidate in the Molecular Biology program.

Her research focuses on DNA replication and chromosome segregation in the budding yeast. Marie served as GSS Historian from 2006 to 2008.

Markus Gnerlich is a Ph.D. candidate in Electrical Engineering at the Electrical and Computer Engineering Department under the supervision of Prof. Svetlana Tatic-Lucic.

Currently, his research work is focused on Bio-MEMS and photolithogrphic fabrication of polymer MEMS actuators and sensors suitable for measurements of mechanical properties at the cellular level.

Federico Halpern is a Ph.D. candidate in the department of Physics at Lehigh University. His doctoral dissertation focuses on computer modeling of magnetic confinement fusion relevant tokamak plasmas. He served as the Graduate Student Senate Treasurer, and previously as the Graduate Student Senate Unit Representative for the Physics department.

Hannah Dailey is a Ph.D. candidate in Mechanical Engineering and her research interests include cellular biomechanics and lung injury. During her time at Lehigh, Hannah has been actively involved in the Graduate Student Senate, serving as Secretary for two years and as President for 2007-2008. In her free time, Hannah also enjoys running, knitting, and taking ballet classes.

Jordan Knicely is a first-year Ph.D. candidate in Psychology at Lehigh University. His research interests include language production, the interactions between verbal and spatial forms of recall, and how experience alters perception.

Abstracts from the College of Arts and Sciences

The College of Arts and Sciences is home to the social sciences, arts, humanities, and natural sciences. Collectively, these disciplines provide the foundation of a liberal arts and sciences education that is the core of every Lehigh degree. The College seeks to maximize student growth and development while placing the individual in the broader context of human culture and the natural world. Classrooms extend beyond four walls to the broader community and to countries spanning the globe.

The largest of Lehigh's four colleges, the College includes 18 departments and 20 interdisciplinary programs. The College offers 50 undergraduate majors, 53 undergraduate minors, 29 graduate programs (M.A., M.S., and Ph.D.), and seven graduate certificate programs. The College is home to 213 tenure-track faculty (and 14 open positions for this academic year), 75 staff, 50 to 60 research scientists and scholars, over 2,100 undergraduates, over 500 graduate students, and nine centers and institutes including the Berman Center for Jewish Studies, the Gipson Institute for 18th Century Studies, and the Environmental Initiative.

In the natural sciences, work focuses on the life sciences, the environment, and nanotechnology. Each of these foci benefits from the interdisciplinary approach to research, realizing contributions from earth and environmental science, biology, chemistry, and physics. In the arts, the College has developed strength in performance and the visual/design arts and a new program in creative writing. The departments of music and theatre are housed in the Zoellner Arts Center. In the social sciences, the College has recognized strength in international relations and is developing a new initiative in globalization and social change that will explore issues such as identity and culture, communication, social transformation, and health and aging. In the humanities, the College has established strength in literature, religion studies, philosophy, and a new initiative in ethics and decision-making.

The College of Arts and Sciences subscribes to the belief that a liberal education is essential for success in today's global society. It promotes diversity and debate, and an ability to think creatively and work with others. Knowledge advances more quickly when working together; the College's synergistic, interdisciplinary approach to research and education reflects the needs and desires of an ever more interconnected — and interdependent — world community.

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Stepping Off the Pendulum: Why Only a Thoroughly Action Based Approach Can Fully Transcend the Nativist Empiricist Epicycles and Ground Mind in the Natural World.

Jedediah W.P. Allen (Lehigh University)

Recent psychological proposals have attempted to reconcile the history of errors inherent to nativist and empiricist positions. These proposals share in their rejection of the nativist-empiricist debate as misguided or altogether incoherent—subsequent solutions typically take the form of some eclectic union or outright dismissal. The central thesis of this paper is that, in dissolving or ignoring the distinction between nativism and empiricism, researchers have failed to accomplish the shared goal of transcending the limitations inherent to their respective positions. Nativism and empiricism are two distinct attempts to account for the source of our knowledge. While different in this respect, they share in their commitment to foundationalism and both have a strong tendency towards anti-constructivism. Foundationalism is contrary to both a developmental perspective and to naturalism: any foundation that cannot itself be accounted for (in principle), must be wrong. An action-based approach constitutes a positive alternative to the problems inherent in foundationalism and it was this important difference that separated Piaget from both nativists and empiricists. Of contemporary relevance, a series of infant studies have revealed alternative perceptual explanations for a number of classic nativist experiments. We suggest that the failure of past researchers to provide these perceptual controls was

derivative from their nativism and its anti-constructivist corollary.

Jean Piaget Society
Amsterdam (May 31, 2007)

Social Explanatory Style as a Foundation of Empathic Orientation

Michael R. Andreychik (Lehigh University), Michael J. Gill (Lehigh University)

We examined whether people's social explanations—the explanatory frameworks they use to make sense of others' behaviors and outcomes—are tied to their social orientation, or the extent to which they demonstrate tendencies such as empathy and forgiveness. While evidence for a social explanatory style (i.e., a characteristic manner of explaining behavior across targets and contexts) was mixed, results demonstrated that social explanations interacted with epistemic motives (e.g., attributional complexity) to predict social orientation.

Eastern Psychological Association Annual Conference
Philadelphia, PA (Mar 24, 2007)
Eastern Psychological Association

Belief in Human Kinds versus Belief in Inherent Character: Which Type of Essentialism is Associated with Prejudice?

Michael R. Andreychik (Lehigh University), Michael J. Gill (Lehigh University)

Recently, scholars have begun to examine the possibility that essentialism of social groups—a belief that social groups are bound together by "deep" properties—is linked to negative intergroup attitudes. Attempts to document such links have met with mixed success however. Some scholars have found that essentialistic beliefs are associated with prejudice (Keller, 2005), whereas others have found puzzling and inconsistent patterns (e.g., Haslam, Rothschild, and Ernst, 2000).

We propose that relations between essentialism and prejudice will become clearer once a distinction is made between two types of essentialistic beliefs. The distinction is between a belief in social groups as human kinds, which involves the notion that membership in a social group—typically defined in terms of physicality—is linked to an underlying property, versus a belief in social groups as possessing inherent character, which involves the notion that the behaviors, cognitions, and emotions of a group grow out of an underlying property. We expect that prejudice will be most strongly associated with this latter type of essentialism.

In two correlational studies testing our hypothesis in the context of both gender and racial attitudes, scores on an "Essentialism of Inherent Character" Scale were significantly related to prejudice such that those endorsing biological explanations for gender- or race-linked behavior, cognition, and emotion showed higher levels of prejudice. In contrast, scores on an "Essentialism of Physical Attributes" Scale showed no relation to prejudice. It thus appears that essentialism does beget prejudice, but only if it is essentialism of inherent character.

Association for Psychological Science Annual Convention

Washington, DC (May 25, 2007)
The Association for Psychological Science

Ingroup Identity Moderates the Impact of Social Explanations on Prejudice: External Explanations for the Low Status of an Outgroup are not Necessarily a Good Thing

Michael R. Andreychik (Lehigh University), Michael J. Gill (Lehigh University)

Whereas the Social Explanations Framework (Gill & Andreychik, 2007a) suggests that external explanations regarding a low status group (e.g., discrimination) will foster positive attitudes, Social Identity Theory (Tajfel & Turner, 1986) suggests that such explanations can increase prejudice. Two studies suggest that the Social Explanations Framework captures the psychology of dominant group members who are weakly identified with the dominant ingroup, whereas Social Identity Theory captures the psychology of high identifiers.

Eastern Psychological Association Annual Conference
Boston, MA (Mar 14, 2008)
Eastern Psychological Association

Ingroup Identity Moderates the Impact of Social Explanations on Prejudice: External Explanations for the Low Status of an Outgroup are not Necessarily a Good Thing

Michael R. Andreychik (Lehigh University), Michael J. Gill (Lehigh University)

Two studies suggest that level of identification with the dominant ingroup moderates the effect of external explanations— which frame a group as responding to societal circumstances "just as any group would"—on attitudes toward low status outgroups.

Association for Psychological Science Annual Convention
Chicago, IL (May 23, 2008)
Association for Psychological Science

Familiarity and Emotion Adaptation

Susan Barrett (Lehigh University), Alice O'Toole (University of Texas at Dallas), Leigh Richards (Lehigh University)

Familiarity with a face strengthens identity adaptation aftereffects and increases the degree to which adaptation effects transfer across changes in view (Jiang et al., 2007). In the present study, we examine whether familiarity with an emotionally expressive face has a similar effect on emotion adaptation. Participants were familiarized with dynamic emotionally expressive faces. After familiarization, emotion adaptation effects were assessed for familiar and unfamiliar faces. In our study, familiarization was associated with a restriction in the range of values that produce a strong adaptation effect. More specifically, adaptation effects were weaker at intermediate morph levels for familiar faces than they were for unfamiliar faces. These findings suggests that adaptation effects can be used to study how perceptual mechanisms are fine tuned to recognize subtle emotional expressions.

Vision Sciences Society Annual Meeting
Sarasota, FL (May 11, 2007)
Vision Sciences Society

Direct measurement of hematite individual particle anisotropy: implications for inclination shallowing in red bed DRMs.

Dario Bilardello (Lehigh University), Kenneth P. Kodama (Lehigh University)

Methods to correct for the observed inclination shallowing in sedimentary rocks have been proposed that are based on either models of the geomagnetic field and the resulting directional distribution of paleomagnetic vectors or the magnetic anisotropy of the magnetic minerals carrying the remanence. One limitation of the anisotropy method for hematite-bearing red beds has been the isolation and determination of a rock's detrital hematite individual particle anisotropy. Up to now, our red bed inclination shallowing corrections have been dependent on estimates of hematite individual particle anisotropy using data fit to theoretical correction curves.

We have developed a technique for preferentially extracting the detrital hematite particles in a sample in order to directly measure their individual particle anisotropy. The method involves crushing of the sample followed by ball milling and sieving to ensure that the rock particles are smaller than 4Φ. The resulting slurry was then placed in an ultrasonic cleaner for at least 24 hours and finally centrifuged at 1000 rpm for 20 minutes in order to separate the dense, gray iron oxide particles from the red pigmentary grains. The gray, iron oxide-rich slurry was collected by hand and circulated in a magnetic extraction apparatus. The magnetic separate was then collected over a period of two to three weeks.

Small amounts of the magnetic separates where mixed in a slow-drying epoxy resin for 24 hours and placed in a DC magnetic field (100 mT to 180 mT) in order to align the grains. The bulk IRM anisotropy of the epoxy samples provides an average individual particle anisotropy for the magnetic grains. Separates were collected from samples of the Mauch Chunk Fm. of Pennsylvania, the Maringouin and the Shepody Fms of New Brunswick/ Nova Scotia and the Kapusaliang Fm. of northwestern China.

IRM acquisitions experiments were performed in fields of up to 1.2 T in order to identify the magnetic mineralogies present. Remanence appears to be carried by a low coercivity phase (~50 mT) interpreted to be secondary magnetite and a higher coercivity phase (~350 mT) interpreted to be primary hematite for the Shepody and Maringouin Fms or just one high coercivity component (200- 250 mT) interpreted as primary hematite for the Mauch Chunk and Kapusaliang Fms.

Hematite individual particle anisotropy was measured by imparting a 1.2 T IRM to the specimens in 9 different orientations followed by AF demagnetization at 100 mT. Calculated individual particle anisotropy values ranged between 1.28 and 1.45 with bulk anisotropies of ~40\%. Inclination corrections using the directly measured individual particle anisotropies indicate significant inclination shallowing for the Mauch Chunk and Kapusaliang Fms, while more moderate shallowing for the Maringouin and Shepody Fms.

Curve fitting techniques with added constraints give a good first order approximation of the individual particle anisotropy, however direct measurement is preferable. The mea-

sured particle anisotropies for hematite are low and suggest that there is the potential for significant amounts of shallowing for a hematite DRM. This observation is consistent with redeposition experiments performed by Tauxe and Kent [1984] and the notion that depositional inclination of hematite may suffer from more shallowing than magnetite because of its lower spontaneous magnetization making it more affected by gravitational forces.

American Geophysical Union, Fall Meeting
San Francisco (Dec 10, 2007)
American Geophysical Union

Role of Reactive Surfactants in Miniemulsion Polymerization

Samantha Braganza (Emulsion Polymer Institute- Lehigh University)

Keywords: Reactive Surfactants, Miniemulsions, Polymers

Reactive surfactants show a promising approach to reduce the negative effects where by the surfactant is chemically incorporated into the latex particles during the course of the polymerization so that desorption of the surfactant from the latex or migration in the resulting polymer film is impeded. One of its main characteristics is that reactive surfactant should be incorporated onto the polymer particles surfaces at the very end of the reaction process .Miniemulsion polymerization is therefore proposed as an alternative process to increase the amount of the surfactant incorporated on the particle surfaces and to minimize the amount of the buried surfactant since miniemulsion polymerize primarily via droplet nucleation mechanism.

Two reactive surfactants HITENOL BC-20 (polyoxyethylene alkylphenyl ether ammonium sulfate) (anionic) and HITENOL KH-10 (sodium polyoxyethylene alkylether sulfuric ester) (anionic) are used in this study. Styrene miniemulsion polymerizations and conventional emulsion polymerizations were conducted in the Mettler RC1 reaction calorimeter to determine the reaction kinetics and produce particles for latex characterization
The extent and rate of incorporation of the reactive surfactant in the polymer particles is an important information involving the determination of the amount of bound reactive surfactant in the polymer latex particles and this will be monitored as a function of surfactant location and polymerization time to determine whether the miniemulsion technique can offer some advantage compared to conventional emulsion polymerization process. To characterize the latexes prepared by miniemulsion polymerization and conventional emulsion polymerization, serum replacement technique/UV method was applied in order determine the distribution of the reactive surfactants in these latexes.

SPE Polymer Nanocomposites 2007
Bethlehem, PA (Mar 7, 2007)

Representing the Yellow 'Other': Japan and China in American Popular Culture 1924-1942

Joshua A. Britton (Lehigh University Department of History)

The National Origins Act of 1924 effectively ended Japanese immigration into the United States. The act was a response to pressures from Progressive eugenicists and West Coast

agricultural interests who feared competition from Japanese migrant workers. The passage of the National Origins Act also ended a period in which American political leaders saw Japan as a close partner and protégé to the United States, and began a slow process in which the American people "othered" Japan. American filmmakers, writers, artists and other popular culture figures were deeply involved in "othering" Japan and the Japanese, and ultimately rehabilitating the image of China and the Chinese, who had, up until that time, been seen as "the great yellow peril" and much more of a threat than the Japanese, who were seen as much more "like" Americans. Ultimately, those similarities would prove to be Japanese-Americans' undoing.

Contrary to historian Roger Daniels's assertion that most Americans would have welcomed the exclusion of Japanese immigrants in 1924, this paper shows that at worst, Japanese immigrants were tolerated by a majority of the country and only after the Japanese invasion of Manchuria in 1937 did most Americans perceive Japan and Japanese-Americans as a threat. These attitudes are reflected in the popular culture of the time. The presentation will examine comic strips, radio programs, movies and popular fiction to trace the evolution of pro-Sino and anti-Japanese sentiments among the average American. The development of these sentiments would be an important step in the popular support for President Roosevelt's Executive Order 9066, which allowed for the internment of over 120,000 Japanese-Americans.

Warren I. Susman Graduate Student History Conference
Rutgers-New Brunswick (Apr 5, 2008)
Rutgers University Graduate History Club

Peat Accumulation of a Sphagnum Poor Fen in Temperate East Pennsylvania during the Holocene

Shanshan Cai (Department of Earth and Environmental Sciences, Lehigh University), Zicheng Yu (Department of Earth and Environmental Sciences, Lehigh University), Robert K. Booth (Department of Earth and Environmental Sciences, Lehigh University), Steve Frolking (Institute for the Study of Earth, Oceans, and Space, University of New Hampshire), Glen M. MacDonald (Department of Geography, University of California, Los Angeles)

Climate change can greatly affect the carbon balance of peatlands by influencing production and decomposition. Studying boreal peatlands along the edge of their southern range may provide insight into boreal peatland responses to warmer climates. Here we present results of AMS dating (n=9), 268 bulk density measurements and macrofossil analysis of a 10.7-m peat core from Tannersville Bog, one of the southernmost (41°N) low altitude (277 m) Sphagnum peatlands along the eastern seaboard of North America. Results indicate a concave peat-age pattern over the last ~11 cal ka, similar to patterns documented in oceanic bogs but different from those of continental fens. The peat-addition rate of ~120 g per square meter per year was higher than most boreal peatlands, but catotelm decomposition rate was similar (0.0002 yr-1) to other peatlands. Apparent accumulation rates ranged from 13 to 109 gC per square meter per year, with a time-averaged mean of 28 gC per square meter

per year. This relatively high accumulation rate may have been caused by high primary production (rather than low acrotelm decomposition) associated with a warmer and wetter climate. Plant macrofossil data indicate a major transition from rich fen to poor fen at ~1.2 cal ka, possibly triggered by a dry and/or variable climate as documented at other sites in the region. Our results imply that a warmer and wetter climate may increase carbon storage in some regions for certain types of peatlands.

AAG 2008 Annual Meeting
Boston, Massachusetts (Apr 15, 2008)

Computing Multiple Dirichlet Series in a Rational Function Field

Gautam Chinta (City College of New York), Joel B. Mohler (Lehigh University)

Association of American Geographers
Keywords: Multiple Dirichlet Series

Friedberg, Hoffstein and Lieman showed how to construct two related multiple Dirichlet series from quadratic and higher-order twisted L-functions and Gauss sums. We compute these multiple Dirichlet series explicitly in the case of the rational function field. This is done by utilizing the functional equation of the L-functions and the functional equation relating the two multiple Dirichlet series. We also point out a very simple correspondence between the p-parts of these series and their sums.

AMS Sectional Meeting -- Eastern Section
Hoboken, NJ (Apr 15, 2007)
American Mathematical Society

Cape Town Meets the Classroom: Fostering Global Citizenship Through Writing About Study Abroad (co-authored)

Colleen Lutz Clemens (Lehigh University, English), Elizabeth Vogtsberger (Lehigh University, English)

This paper will describe our experiences teaching Global Literature to first-year students in Lehigh University's Global Citizenship Program (GCP). After participating in an intersession trip to Cape Town, we returned to help our students process their experiences through carefully-selected African written and filmic texts and individually-tailored writing assignments. We designed the syllabus with two questions in mind: How can we transcend the identity of the "traveler" and become "global citizens"? What can we do in our own backyards? The first addresses the process of self-reflection, evaluation, and transformation the students undergo. In reading contemporary African stories and reflecting on the trip, we hope each student will begin to understand his/her place in the world and his/her potential to impact the global community. The second emphasizes that the global citizen can apply what s/he has learned abroad to his/her own community. Our course stresses that travel is not merely a one-way trip, but instead a means of adapting lessons learned in the world to one's everyday experiences. A commitment to collaborative learning, interdisciplinary approaches, and the understanding that global citizenship is not a moral imperative informs our pedagogy; each student must come to his/her own definition of global citizenship. Our paper will share our observations of the students'

transformations articulated through their writing and explain the course's rationale.

Rocky Mountain Modern Language Association
Calgary, Canada (Oct 4, 2007)

Parental discipline in adolescent development: The role of guilt and shame.

Jessica Eye (Lehigh University), Debbie Laible (Lehigh University)

Keywords: Discipline, Parenting, Guilt, Shame

The tendency to experience the moral emotion of guilt is an important aspect of human development. The experience of guilt preserves relationships after a real or perceived wrongdoing by motivating individuals to repair the situation or apologize (Eisenberg, 2000). But immoral acts do not always elicit guilt in individuals. Oftentimes people experience other emotions, such as shame, after a transgression. However, the experience of shame brings about self-focused behaviors, such as avoidance, rather than reparation (Eisenberg, 2000). Therefore, it is evident that the tendency to experience guilt is critical in the formation and preservation of relationships. Some insight on how to foster guilt development in children can be extremely useful for parents. One way parents may be able to foster guilt in children is by employing appropriate discipline techniques. However, research examining a link between parental discipline and the self-conscious moral emotions has been scarce. Most of the work that has been done focuses on young children. Prior research has shown that inductive discipline and/or guilt development in childhood leads to positive outcomes, such as higher levels of empathy and prosocial behavior (Gibbs, 1996). The current study emphasizes the importance of examining such links in adolescence, as well.

It is crucial to understand how entering adolescence affects the links that have previously been shown to exist between parental discipline and guilt in children. In addition, it is important to know whether the experiences of inductive discipline and/or guilt in adolescence lead to the same positive outcomes as they do in childhood. The current study utilized measures of parental discipline (Loeber, Stouthamer-Loeber, van Kammen & Farrington, 1991 and Holden & Zambrano, 1992), guilt and shame (Tangney, Wagner, & Gramzow, 1989), empathy (Davis, 1983), and prosocial behavior (Carlo & Randall, 2002). 112 adolescents (M age = 15.88 years, SD= 1.35 years, 55.4% Caucasian) in urban Pennsylvania public high schools completed the measures in paper-and-pencil questionnaire format with the aim of broadening the scope of research on these topics.

In order to examine how parental discipline related to adolescent moral development, correlational analyses were performed (see Table 1). As was expected, both maternal and paternal inductive discipline were positively related to the experience of guilt adolescents. Unexpectedly, however, inductive discipline by both parents was positively related to adolescent shame, as well. Power assertion by both parents was negatively

associated with the experience of guilt, as was predicted, but unrelated to shame. As hypothesized, both maternal and paternal power assertion were negatively related to internalization scores. Also as predicted, adolescent guilt was positively correlated with perspective-taking and empathy scores; however, there was an unexpected positive correlation between shame and these variables, as well. Lastly, as expected, guilt was positively related to various types of prosocial behaviors.

Overall, parental inductive discipline appears to be quite critical for adolescent moral emotional development, particularly for fostering guilt, shame, internalization, and perspective-taking. In addition, parental power assertion seemed to undermine adolescent development in a number of important ways. Not only was parental power assertion negatively correlated with adolescent guilt, internalization, empathy, and perspective-taking, it was also associated with lower frequencies of various types of prosocial behavior. This finding is consistent with what is currently known about adolescence. Power assertive discipline by parents of adolescents is in direct opposition to the adolescents' striving for autonomy, likely leading to rejection of parental messages. This study demonstrates that even during adolescence, when adolescents are striving for autonomy, parenting techniques still play a critical role in moral emotional development. Future studies using longitudinal designs and exploring a broader range of factors such as temperament, gender, modeling by parents, and family climate in general could aid in further understanding the effects of parenting on adolescent development. In addition, it would be useful to explore additional parenting techniques, such as love withdrawal, and to determine the effects of such techniques on the moral development of adolescents. Research examining the impact families have on adolescent moral-emotional development quite scarce; however, this study demonstrates that the teenage years should not be overlooked.

Society for Research on Adolescence Biennial Meeting Chicago, IL (Mar 6, 2008)
SRA

The Last Regulator of the Fictive: Making Connections and Finding Precursors to David Markson's Vanishing Point

Jamey Gallagher (Lehigh University)

In this paper I weave together three short essays with reactions to and comments on the act of reading David Markson's novel Vanishing Point. Italicized sections are a dramatization of one reader's attempt to puzzle out this unconventional work, which, in its simplest form, is constructed of the detritus of the lives of great Artists. The essays view the piece through a critical framework (Foucault), make an important connection between this work and The Anatomy of Melancholy, a seminal creative/scientific work from the 17th Century, and suggest a possible scientific-cultural extension of the ideas discussed, through memetics. These essays are both digressive and progressive. In its totality, the paper offers a relational, discursive, and not nearly comprehensive

reading of Markson's elliptical novel, which is both experimental and traditional.

The Thread of Narrative: Directions and Digressions in the Storytelling Process
Daemon College, Buffalo, NY (Oct 13, 2007)
New York College English Association

Sex recognition by pupfish: who are female mimics fooling?

Jennifer M. Gumm (Lehigh University)

Species, sex and mate-quality recognition are vital to maximizing individual reproductive success. In male Comanche Springs pupfish (Cyprinodon elegans), small males have morphological and behavioral characteristics similar to females. Female mimicry may allow them to avoid aggression by larger territorial males and garner matings in a large male's territory. However, selection is predicted to favor large males' ability to discriminate against female mimics as they may usurp fertilizations in a male's territory and potentially eat eggs fertilized by the territory owner. Results of a field study conducted at Balmorhea State Park, Balmorhea, TX show that territorial males behaviorally discriminate based on size and sex. They are more aggressive to large males than to female mimics. Additionally, territorial males discriminate against female mimics, directing more aggressive behaviors to female mimics than similarly sized females. These results suggest that female mimicry may not be an effective tactic for small males. However, as female mimics garner little aggression when a large male intruder is also present, they will potentially gain opportunities to spawn if large males commonly intrude into males' territories. These results imply that complex interactions among males expressing alternative mating tactics may have important evolutionary consequences in fitness for both territorial males and female mimics.

Texas Academy of Science 111th Annual Meeting
Corpus Christi, TX (Mar 7, 2008)
Texas Academy of Science

Neighbor interactions among male Cyprinodon elegans: Does size influence the development of 'dear enemy' recognition?

Jennifer M. Gumm (Lehigh University)

Territorial males of many pupfish species exhibit dear enemy recognition, displaying less aggression to neighbors than to unfamiliar intruders. Familiarity may play a role in the development of dear enemy recognition if established neighbors save time and energy through decreased aggression. This hypothesis predicts that a territory owner decreases the intensity of aggressive responses to neighbors over time. I tested this prediction in male Cyprinodon elegans. Males have conditional alternative reproductive tactics with larger males defending territories around spawning sites, intermediate males as non-territorial satellites and smaller males as sneakers with female-like morphologies. The largest males in a population are territorial, but in absolute size; they may be intermediate or small. Therefore, aggressive behaviors and neighbor interactions were assessed across the time period of territory establishment for large, intermediate and small males. Selection for dear enemy recognition may be stronger on

large males compared to intermediate and small males that do not typically hold territories in natural populations.

Animal Behavior Society 44th Annual Meeting
Burlington, VT (Jul 21, 2007)
Animal Behavior Society

Causes and consequences of population decline in an endangered pupfish, Cyprinodon bovinus

Jennifer M. Gumm (Lehigh University), Jennifer L. Snekser (Lehigh University), Murray Itzkowitz (Lehigh University)

When intrasexual interactions influence reproductive success, declines in population size may alter individual reproductive success as well as the breeding system of the species. The endangered Leon Springs pupfish, Cyprinodon bovinus, has a breeding system where large males defend territories around female oviposition sites, while smaller males show 'satellite' or 'sneaker' tactics to gain matings. In related species, absence of territorial males results in satellites taking over territorial vacancies. However, despite a decline in number of territorial males, we observed an altered breeding system with satellites not becoming territorial. Territorial males with neighbors have few heterospecific intruders and we hypothesize territoriality is no longer beneficial to satellites due to the lack of interaction with territorial neighbors. We examine the costs of both strategies in number of intruders present at spawning and benefits in number of spawnings. In addition, large numbers of a pupfish egg predator, the endangered Gambusia nobilis, may be contributing to the decline of C. bovinus. We discuss management implications when one endangered species threatens another.

Southwestern Association of Naturalists 54th Annual Meeting
Stephenville, TX (Apr 19, 2007)
Southwestern Association of Naturalists

Function of Clathrin and Accessory Proteins in Gap Junction Internalization

Anna Gumpert (Lehigh University), Matthias M Falk (Lehigh University)

Gap junction (GJ) channels cluster into arrays termed plaques providing direct cell-to-cell communication between neighboring cells. A gap junction channel consists of two hemichannels, termed connexons, one from each of the apposing cells. Having a half-life of only a few hours the channelas have been described as dynamic structures. Recently we have shown, that the extent of gap junction intercellular communication (GJIC) is directly related to the dynamics of plaque formation and degradation. In addition to a continuous turnover of channels (as we reported in Lauf et al., 2002), large portions of clusters or even entire plaques can be removed from the plasma membrane in a clathrin-dependent process, resulting in the formation of double-membrane vesicles (as our group reported in Piehl et al., 2007) termed annular gap junctions (AGJs).

Here, we report the involvement of clathrin, the classical and alternative clathrin adaptors AP-2 and Dab2, and the accessory

protein dynamin2 (Dyn2) in the process of GJ internalization. Co-localization studies showed an accumulation of those proteins on GJs in the plasma membrane as well as on internalizing GJs. The function of each protein in GJ internalization was tested by RNAi-based knock-down assays. Down-regulation of clathrin, AP-2, Dab2 and Dyn2 significantly reduced the number of internalized GJ vesicles, without having a negative effect on GJ protein synthesis and channel assembly. Quantitative evaluation of knock-down assays of each of the tested proteins revealed an inverse correlation between significant reduction of the number of AGJs and the increase of GJ plaque size and number.

47th Annual Meeting, American Society for Cell Biology, Washington DC (Dec 1, 2007)

PTRANSP Simulations of Toroidal Momentum Transport in Neutral Beam Heated Tokamak Plasmas

Federico David Halpern (Lehigh University), Glenn Bateman (Lehigh University), Arnold H. Kritz (Lehigh University), Alexei Y. Pankin (Lehigh University), Robert V. Budny (Princeton Plasma Physics Laboratory), Douglas C. McCune (Princeton Plasma Physics Laboratory)

The PTRANSP code is used to predict self-consistently the toroidal rotational frequency, electron temperature, ion temperature, and **E × B** flow shear rate. Turbulence-driven thermal transport and toroidal momentum transport are computed using several transport models. A neoclassical contribution is added to the turbulence-driven toroidal momentum transport and thermal transport. It is found that inward fluxes of momentum can be generated by the Reynolds stress in the Weiland transport model. The neutral beam injection torque input, computed using the NUBEAM code, drives rotation in the plasma core, while charge exchange can drive rotation near the plasma edge. The poloidal velocity is computed using neoclassical theory. In H-mode discharges, it is found that the largest contribution to the **E × B** flow shear is usually a consequence of toroidal rotation. The rotation frequency is investigated as a function of plasma parameters including the torque per particle. The simulated radial profiles of the toroidal rotational frequency, ion temperature, and electron temperature are compared with experimental data.

49th Annual Meeting of the American Physical Society Division of Plasma Physics Orlando, FL (Nov 15, 2007) American Physical Society

Comparison of GLF23 and Weiland Models for Turbulent-Driven Toroidal Momentum Transport

Federico D. Halpern (Lehigh University), Arnold H. Kritz (Lehigh University), Glenn Bateman (Lehigh University), Tariq Rafiq (Lehigh University), Alexei Y. Pankin (Lehigh University)

Integrated modeling simulations using the GLF23 model indicate that the **E×B** shear driven by toroidal rotation can have a significant impact upon the fusion performance of ITER [1]. The focus of this work is to advance the understanding of toroidal momentum transport by carrying out a systematic comparison of the toroidal momentum diffusivity computed by the GLF23 [2] and Weiland [3]

models. The GLF23 model is used to compute toroidal momentum transport driven by ion temperature gradient (ITG) and trapped electron mode (TEM) in the quasilinear approximatin. The Weiland model, in addition to ITG/TEM toroidal momentum transport in the quasilinear approximation, includes non-linear contributions to transport such as a momentum pinch effect that is driven by the Reynolds stress. Benchmarking of both momentum transport models against experimental data is carried out with the PTRANSP code. Also, a direct comparison between GLF23 and the Weiland model is also carried out using a stand-alone code, where the parametric dependence of the momentum diffusivities can be determined in a straightforward manner. The variation of toroidal momentum transport with respect to plasma parameters such as temperature gradient, radial gradient of toroidal velocity, plasma beta, collisionality, and magnetic shear is examined. The **E×B** flow shear that is needed to stabilize anomalous transport depends on the threshold and stiffness of the transport models.

[1] G.M. Staebler and H.E. St. John, Nucl. Fusion 46 (2006) L6.

[2] R.E. Waltz el al., Physics of Plasmas 4 (1997) 2482.

[3] J. Weiland and H. Nordman, Proc. 33rd EPS Conf. on Plasmas Physics, ECA Vol 30I, P2.186 (2006).

21st US Transport Taskforce Workshop
Boulder, Colorado (Mar 25, 2008)
United States Department of Energy

Investigation of colloidal interactions in nanoparticle

Joseph Junio (Lehigh University), H.D. Ou-Yang (Lehigh University)

Keywords: colloid optical trap

Colloidal interaction parameters such as virial coefficients or bulk modulus are traditionally measured by scattering methods. However, experimental difficulties often limit the range of applications of these methods to idealized systems. Multiple optical tweezers have also been used to study interparticle forces, but this has been limited to micron size individual particles at infinite dilution. We propose a new approach to investigate many body interactions of sub-micron colloidal particles in native suspensions with a single optical trap. Using a blinking optical trap and confocal detection of optical signals, this approach can be used to measure many body interactions in suspensions of colloidal particles in the range of tens to hundreds nanometers in size.

APS March Meeting
New Orleans (Mar 11, 2008)

Becoming Supervisors: Tips for the Transition

Anju Kaduvettoor (Lehigh University), Tiffany O'Shaughnessy (Lehigh University), Ryan Weatherford (Lehigh University), Yoko Mori (Lehigh University), Clyde Beverly, III (Lehigh University), Nicholas Ladany (Lehigh University)

Researchers have noted that trainees navigate potentially conflicting roles such as student, therapist, supervisee, and colleague (Holloway, 1984; Ladany & Friedlander, 1995).

The transition from trainee to new supervisor presents unique challenges that are the focus of this presentation. We utilize current research on supervisory best practices, as well as our own early supervision experiences to provide the new supervisor with a framework to better understand their new role. We address major concerns such as setting the tone for supervision (e.g., addressing cultural issues, reviewing role expectations, managing role conflict and role ambiguity, providing summative and formative evaluations, and using what you know from counseling in supervision). Additionally, we discuss incidents that beginning supervisors might encounter in their first supervision experiences (e.g., supervising people with more experience, addressing supervisee anxiety, and how to handle resistance, parallel process and supervisee non-disclosures). Finally, we present ways to boost novice supervisor self-efficacy (i.e., using peer supervision and managing own anxiety).

Mid-Atlantic Regional Group Meeting of the Society for Psychotherapy Research
New York, New York (Oct 6, 2007)
Society for Psychotherapy Research

Theoretical Studies of Dissociative Recombination

D. O. Kashinski (Lehigh University), R. F. Malenda (Lehigh University), A. P. Hickman (Lehigh University), D. Talbi (Universit´e Montpellier II)

Keywords: Dissociative Recombination, electronic structure calculations

We are currently investigating the dissociative recombination (DR) of electrons with molecular ions such as N_2H^+ and $C_3H^+_3$. Both these ions exist in the interstellar medium, and accurate DR rate constants are needed for astrophysical models. Elaborate electronic structure calculations of potential surfaces for $e^- + N_2H^+ \rightarrow N_2 + H$ have been carried out in the linear geometry [D. Talbi, Chem. Phys. 332, 289 (2007)]. Additional work is necessary to determine the autoionization width Γ, which is essential for a dynamics calculation. We are using the block diagonalization method to determine both diabatic potential curves and Γ; the status of the calculations will be presented at the conference. In addition, preliminary work on the $C_3H^+_3$ molecular ion has investigated the normal modes of the motion. We expect that energy flow into and out of the vibration of a single CH bond may influence the overall DR dynamics, and we account for this effect using an appropriate quantum mechanical wave function for the initial state.

APS-Division of Atomic Molecular and Optical Physics (DAMOP)
State College PA (May 27, 2008)
Penn State University

Strong Attractions with Controllable Size between Hydrophilic Inorganic Macroanions and Reversible Supramolecular Formations

Melissa Kistler (Lehigh Univeristy), Tianbo Liu (Lehigh University)

The polyoxometalate (POM) hydrophilic macroionic solutions, offer a direct connection between traditional fields of simple inorganic ions, colloidal suspensions, polyelectrolytes, particularly proteins and DNAs.

Many types of POM macroanions are highly soluble, but undergo reversible self-assembly to form uniform, stable, soft, single-layer vesicle-like "blackberry" structures containing >1000 individual POMs in dilute solutions. Blackberry structures represent a new state of soluble inorganic ions. The driving forces of the POM self-assembly are unlike those of surfactant micelles or colloid aggregates. The POM driving forces are most likely counterion-mediated attraction (like-charge attraction). Blackberry size is controlled by the solvent quality, or the charge density of macroions. Blackberry structures may be analogous to virus shell structures formed by capsid proteins. Unexpected phenomena have been observed in the novel POM systems.

References:
JACS. 2005, 127, 6942; 2003, 125, 312; 2002, 124, 10942.
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J. Clust. Sci, 2006, 17, 427.

American Physics Society Meeting
Denver, CO (Mar 6, 2007)

Reversible Self-Assembly of Hydrophilic Inorganic Polyelectrolytes into Highly Conservative, Vesicle-like Structures

Melissa Kistler (Lehigh University), Tianbo Liu (Lehigh University)

The hydrophilic polyoxometalate (POM) macroanions are inorganic polyelectrolytes which offer a direct connection between simple ions and organic polyelectrolytes. POM solutions are perfect model systems for studying polyelectrolyte solutions because they are identical in size, shape, mass and charges, with easily tunable charge density.

Many types of POM macroanions are highly soluble but undergo reversible self-assembly to form uniform, stable, soft, single-layer vesicle-like "blackberry" structures containing >1000 individual POMs in dilute solutions. The driving force of the blackberry formation is likely counterion-mediated attraction (like-charge attraction). The blackberry size can be accurately controlled by solvent quality, or the charge density on macroions. Many unexpected phenomena have been observed in these novel systems. Blackberry structures may be analogous to virus shell structures formed by capsid proteins.

References:
Nature, 2003, 426, 59; JACS, 2002, 124, 10942; 2003, 125, 312; 2004, 126, 16690; 2005, 127, 6942; 2006, 128, 10103.

American Physics Society National Meeting
Denver, CO (Mar 6, 2007)

Gayle Rubin and Cooper's "The Spy": War, Trauma, Rupture, and the "Traffic in Women"

Chris Lang (Lehigh University)

James Fenimore Cooper's revolutionary war novel "The Spy" (1821) foregrounds the trafficking of women in a male patriarchal society, a representation that can be closely analyzed alongside Gayle Rubin's well-known

essay "The Traffic in Women: Notes on the 'Political Economy' of Sex" (1975). The ambiguous nature of female identity during this period relates to a breakdown of fundamental assumptions underlying the traditional structure of the sex/gender system. Close bonds formed between men during war challenge the power of heterosexuality that constrains female sexuality. As Cooper's men are traded back and forth between loyalist and rebel camps, the clear line between the "traders" and the "traded" becomes ambiguous. Women can use this opportunity in the breakdown of gender roles to inscribe themselves into a traditionally male-dominated sphere. The juxtaposition of Frances with her sister Sarah in Cooper's novel highlights fundamental differences in these two contrasting sex/gender systems. Sarah represents a more traditional victim of the traffic in women, while Frances is ambiguously an active participant of, and victim to, this same system. Trauma felt by Sarah occurs in an instantaneous manner, and repeatedly haunts her throughout the novel. Frances, on the other hand, escapes the most severe forms of this experience. War ruptures this character's maturation process from youth to womanhood, and allows her to participate in male systems of exchange as a result. The revolutionary war, in this context, serves as a particular moment in history when traditional social structures are temporarily challenged by an ambiguous displacement of gender roles.

16th International James Fenimore Cooper Conference and Seminar: The Coopers' Worlds: Literature and The Formation of a New American Paradigm
College at Oneonta, State University of New York (Jul 11, 2007)
James Fenimore Cooper Society
&
The 49th Annual Convention of the Midwest Modern Language Associationn
Cleveland, Ohio (Nov 9, 2007)
M/MLA

Does past experience with a male predict female mate choice in the convict cichlid?

Joseph Leese (Lehigh University), Murray Itzkowitz (Lehigh University)

Keywords: convict cichlid, mate choice, intrasexual competition, past experience, female preference

In many monogamous species, both sexes compete for mates and demonstrate mate choice. However, the degree to which intrasexual competition limits the choice of the other sex may not be well known. In this study, we monitored the effects of past experience of male-male competition on the mate preference of female convict cichlids, Archocentrus nigrofasciatus. Females were allowed to interact with two size-matched males while they competed until a winner and loser could be determined. Females were then given a choice between a male she had had past experience with and a novel male. Females were placed in two treatment groups and given a choice between a novel male and 1) a male that had successfully competed against another male (winner) or 2) a male that had unsuccessfully competed against another male (loser). Males were isolated from each other in the experimental aquarium so that intrasexual selection after the initial in-

teraction could not affect the female's preference. Mate preference was determined by observing a time based preference of the female for a specific male. Over a ten day period, females showed a significant preference for a winner male as compared to a novel male. Females did not show a decreased preference for a loser male over a novel male. This study suggests that positive past experience may impact female mate choice, whereas negative past experience may have little or no affect.

44th Annual Meeting of the Animal Behavior Society
Burlington, VT (Jul 21, 2007)
ABS

The Role of Nanosilica Dispersion and Particle Size in Hybrid Epoxy-Silica Nanocomposites

Yi-Ling Liang (Center for Polymer Science and Engineering, Lehigh University), Raymond A. Pearson (Center for Polymer Science and Engineering, Lehigh University)

Keywords: epoxy, hybrid nanocomposite, nanosilica, toughening mechanisms.

Hybrid epoxy-silica nanocomposites (HESN) have been shown to achieve higher fracture energy by adding a small amount of nanosilica with a reactive liquid rubber (CTBN). Previously, we have shown that smaller nanosilica particles (20 nm in diameter) are more effective than larger nanosilica particles (80 nm in diameter). This present study focuses on the effects of rubber particle size and nanosilica dispersion on the toughening mechanism in epoxy based nanocomposites. Core/shell rubber particles consisting of methacrylated butadiene-styrene (MBS) are used to reduce the size of the rubber phase. The fracture toughness and toughening mechanisms have been examined. Interestingly, preliminary results show no substantial toughening synergism in 20HESN/MBS system. Moreover, no considerable nanosilica clustering was detected on the fracture surface. The above observations suggest the importance of nanosilica dispersion status in toughening of HESN and further studies are in progress.

31st Annual meeting of the Adhesion Society
Austin, TX (Feb 17, 2008)
The Adhesion Society

The Role of Cohesion Establishment in Genomic Maintenance

Marie E. Maradeo (Lehigh University), Basanthi Satish (Lehigh University), Robert V. Skibbens (Lehigh University)

Keywords: Chromatid cohesion, genomic maintenance

Genome fidelity and cell fitness relies on a system that ensures that each daughter cell obtain a single copy and only a single copy of every chromosome while maintaining genomic integrity through repair processes. Previously, cohesion establishment was shown to act during S phase through Ctf7p/Eco1p (Skibbens et al 1999, Toth et al 1999) and more recently during DNA damage repair (Sjogren and Nasmyth 2001, Strom et al2007, Unal et al 2007). Although little is known about the process of cohesion establishment research has linked Ctf7p to replication factors PCNA (Skibbens et al 1999, Moldovan et al 2006) and RFC large

subunits Rfc1p, Ctf18p and Rad24p (Skibbens et al 1999, Kenna and Skibbens 2003). This information lead us to hypothesize that Elg1p, the least characterized of large RFC alternative subunits, may also be implicated in cohesion establishment. Genetic screens revealed a role for Elg1p in homologous recombination, replication fork restart, S phase checkpoint pathways and Okazaki fragment maturation (Bellaoui et al 2003, Ben-Aroya et al 2003, Kanellis et al 2003, Banerjee and Myung 2004, Ayora and Kupiec 2005).

Here we show a novel physical and genetic interaction between cohesion establishment factor Ctf7p and alternative RFC large subunit Elg1p. Pull down experiments involving Ctf7p-Gst (Bait) and Elg1p-Myc13 (target) showed a novel physical interaction between these two proteins. Furthermore, ctf7-203 temperature sensitivity is partially suppressed by deletion of ELG1. These results suggest a role for cohesion establishment factor Ctf7p in genome integrity and maintenance.

American Society for Cell Biology 47th Annual Meeting
Washington, DC (Dec 2, 2007)

Tongues on Fire: Alternative Ways of Voicing Resistance to Normative Femininity in Nineteenth Century Victorian Literature

Colleen Martell (English Department)

An important aspect of the role womanhood in the nineteenth century is voicelessness: speaking out against or communicating dissatisfaction with the patriarchal ideology which dominated women's cultural reality was not simple or easy to do. Literature by women in this era seems to respond to oppressive norms of gender by creating female characters who redirect their suppressed voices in creative and often grating but subversive ways. Jane Austen's Persuasion and Charlotte Bronte's Villette characterize the unappealing woman as Mary Musgrove, the whining and weak sister, and Lucy Snowe, the judgmental and standoffish school teacher. What these women characters share is a reaction to patriarchal constraints that is subversive even while it seems perverse (or, perhaps, not feminist). In fact, it is the perversity of these women's methods of resisting norms of femininity which speaks most greatly to their marginal space and their feminist impulses.

Another Way In
Boston College (Mar 31, 2008)

Tenements and Flesh: Poverty writing the Body in Tillie Olsen's Yonnondio

Colleen Martell (English Department)

Olsen's Yonnondio declares that the body is a marker of poverty—a body suffers from, desires regardless of, and effects and is affected by poverty. The female body experiences this marking in a profoundly unique way through childbirth and rearing, relegation to the home and domestic work, and subjugation to men, especially husbands. As a result, the female body inhabits a critical space for understanding the effects of poverty; as Mara Faulkner reminds us, Olsen herself claims that "telling the truth about one's body" is "a necessary, freeing subject for the woman writer" (150).

Through both material and metaphoric descriptions of Anna's sexualized body, her milk-filled breasts especially, Olsen intimately acquaints her readers with the reality of impoverished American life.

12th Annual Working Class/Poverty Class Academics Conference
University of Texas at El Paso (Jul 28, 2008)

Maximizing Third Order Optical Polarizability of Small Organic Molecules Through Donor-Acceptor Substitution

Joshua C. May (Department of Physics and Center for Optical Technologies, Lehigh University), Philip R. La Porta (Department of Physics and Center for Optical Technologies, Lehigh University), Ivan Biaggio (Department of Physics and Center for Optical Technologies, Lehigh University), Filip Bures (Laboratorium fur Organische Chemie, ETH Zurich, Honggerberg, HCI, CH-8093, Zurich, Switzerland), Francois Diederich (Laboratorium fur Organische Chemie, ETH Zurich, Honggerberg, HCI, CH-8093, Zurich, Switzerland)

Keywords: Nonlinear Optics, Third Order Optical Polarizability, Organic Molecules, Donor-Acceptor

We show that a donor-acceptor or push-pull system is an important design strategy for maximizing the off-resonant third-order optical nonlinearity (gamma) in small organic molecules, cyanoethynylethenes. Our work details the two competing contributions to gamma that depend on the conjugation length: the energy corresponding to the first optical transition, and the strength of the transition dipole matrix elements. This competition leads to the weak power-law dependence of gamma that we measured, and depends on the number of conjugated electrons that separate the donor and acceptor (N^1.5). Our molecules have record high nonlinearity relative to their molecular mass and fall within a factor of 50 of their theoretical limits, making them highly attractive candidates for all-optical device integration.

ICONO 10
Santa Fe, NM (May 19, 2008)

Bound-free Emission in the NaK Molecule

B. M. McGeehan (Lehigh University), S. Ashman (Lehigh University), S. J. Sweeney (Lehigh University), C. M. Wolfe (Lehigh University), J. P. Huennekens (Lehigh University), A. P. Hickman (Lehigh University)

We are extending the analysis of the bound-free emission from the 4 $^3\Sigma^+$ electronic state to the $a(1)$ $^3\Sigma^+$ repulsive state of the NaK molecule. In previous work, Burns et al. [J. Chem. Phys. **119**, 4743 (2003)] measured spectra from initial vibrational levels up to v = 8, determined a refined potential for the 4 $^3\Sigma^+$ state, and obtained relative values of the transition dipole moment function $M(R)$ in the range R ~ 26 3.8 Å to 4.6 Å. Recent measurements include data for many additional vibrational levels up to v = 34 of the 4 $^3\Sigma^+$ state. The new data provide information about $M(R)$ for larger values of R, including a region where theoretical calculations have predicted sharp structure due to an avoided crossing. Using a version of R. J. Le Roy's code BCONT that we modified, we will obtain values $M(R)$ for a larger range of R, and we will refine the inner repulsive wall of the

potential for the $a(1)\ 4\ ^3\Sigma^+$ state.

APS Division of Atomic, Molecular, and Optical Physics
State College, PA (May 27, 2008)
The Pennsylvania State University

What's That I Hear: Domestic Surveillance and Counterintelligence on Antiwar Musicians in the 1960s

Kathryn L. Meiman (Lehigh University)

Keywords: Anti-War Protest, FBI, Phil Ochs, Vietnam War

During the 1960's era, the Federal Bureau of Investigation (FBI) engaged in numerous campaigns of intelligence gathering and counterintelligence against an unknown number of targets that were perceived as threats to the American government. Among these targets were numerous musicians who chose to voice protest against U.S. involvement in Vietnam through song. My paper examines the FBI's surveillance and counterintelligence activities carried out against these musicians, most notably folksinger Phil Ochs, and questions whether such efforts were necessary for maintaining national security, or were instead an attempt to compel a more favorable environment for war-making. Looking further, I question whether similar actions could be carried out in today's comparably polarized wartime environment, and what might be done to help protect the voice of peace from an often hostile government.

Annual Meeting of the Peace & Justice Studies Association. Elizabethtown, PA (Sep 28, 2007)

Indians and Dissembling Gentlemen in James Fenimore Cooper's The Pioneers

Keat E. Murray (Department of English, Lehigh University)

It is well-documented that James Fenimore Cooper mined John Heckewelder's History, Manners and Customs of the Indian Nations (1819) for information about the Lenape, Mahican, and Iroquois peoples that populate his Leatherstocking Tales. Scholarship tracing the Moravian's influence on the novelist has consistently asserted both the reliability of Heckewelder's Indians and Cooper's faithfulness to those representations. Still beyond the ken of criticism, however, are matters that complicate Heckewelder's claim that his "unadorned picture" of Indians is disinterested. With this in mind, I re-examine the literary relationship between Heckewelder and Cooper to interrogate in a new light the cultural politics of Cooper's Indians.

I will argue a few points concerning Heckewelder's writings that bear directly on Cooper's Indians and cultural relations in The Pioneers (1823). Heckewelder was not always the "man of probity" that his reputation boasted, for his stature as a judicious, credible gentleman proceeded from his proficiency in dissembling in various capacities, as a patriot spy, ethnographer, and Indian advocate. So too did Cooper dissemble when he launched his literary career "in perfect secrecy," hoping that anonymity would offset the risk of his literary venture to restore the family fortune. Moreover, his early fictions feature noble gentlemen who assume false identities to (re) fortify their gentle status and civic leadership.

What is markedly different about Cooper's production of gentlemen in his third book, The Pioneers, is a new strategy that deploys Heckewelderian Indians as agents in a gentleman's scheme of dissimulation. My explication of this strategy springs from the claim that the "genuine Indians" Cooper found in Heckewelder's History are well-equipped for the novelist's purposes because they are classed representations that naturalize the ascendancy and cultural authority of white gentlemen.

The balance of my paper will show that Heckewelder's representations of Indians, his class bias, and the privilege of dissimulation he exclusively affords gentlemen are serviceable to Cooper's production of an American "natural aristocracy." Specifically, I posit that Indians are instrumental in Cooper's manufacture of honorable gentlemen, whom he ultimately installs as legal and political authorities in a nation listing dangerously toward egalitarianism. Constructing a "natural aristocrat" in Pioneers hinges on a dissembling act that distinguishes an American-born gentleman of noble lineage (Edward Effingham) from his British predecessors and faux gentlemen. Cooper places the young man in Heckewelderian cross-cultural spaces, where his pose as a hybrid "genteel savage" initiates his appropriation of Chingachgook's "natural virtues" and provides for his re-emergence into American society as a distinguished gentleman. In Cooper's cast of characters, only Effingham possesses the comprehensive knowledge of "civilized" and "savage" populations that allows him to salvage vestiges of the degenerated Indian's nobility, a quality of the dying sagamore that the novel dignifies through his steadfast loyalty to the gentry. I further submit that Pioneers's simulation of upward mobility plays well into early nineteenth-century ideologies espousing meritocracy, though it does not efface the novel's greater commitment to producing a static social order and reconfiguring the eminence of American gentlemen as a natural relation consonant with Federalist and Republican politics.

American Literature Association
San Francisco, CA (Jun 22, 2008)
The James Fenimore Cooper Society

TT Hydrae: UV Analysis of an Algol Binary

Michael P. Orleski (Lehigh University), George E. McCluskey, Jr. (Lehigh University)

TT Hydrae (HD 97528) is an Algol-type interacting binary star system composed of a B9.5 V primary star and a K0 III-IV companion in a 6.95 day orbit. The companion fills its Roche Lobe and material is streaming into an accretion cloud around the primary. Ultraviolet spectra from FUSE, IUE, HST-FOS, and HST-GHRS taken over about twenty years are being analyzed to create a model of the gas flow in the system. The spectra are composed of ten emission spectra taken during totality of primary eclipse and eighteen absorption spectra from outside of primary eclipse totality.

211th Meeting of the American Astronomical Society
Austin, TX (Jan 8, 2008)
American Astronomical Society

Blocking Heparin-Induced MKP-1 Synthesis or Activity Intereferes with Heparin-Induced Decreases in ERK Activity

Raymond Pugh (Lehigh University Dept. of Chemistry), Dr. Linda J. Lowe-Krentz (Lehigh University Dept. of Biological Sciences)

Keywords: Heparin, MKP-1, ERK Activity

We have previously identified increases in MKP-1 synthesis in response to heparin treatment of vascular smooth muscle cells (VSMC). The MKP-1 increases correspond to decreased ERK activity in heparin-treated VSMC and were mimicked by treating the cells with antibodies that block heparin binding to cells. Here we report that while treatment of VSMC with heparin prior to activation with PMA resulted in an approximately 30% decrease in ERK activity at 15 min, the presence of vanadate (a tyrosine phosphatase inhibitor) blocked the heparin effect ($p<0.05$) with resulting ERK activity values that were statistically the same as those of cells not heparin treated. Vanadate treatments longer than 30 min. caused loss of cell viability. Previous reports indicated that doxorubicin treatments blocked the synthesis of MKP-1. We therefore evaluated the ability of doxorubicin to block heparin-induced MKP-1 synthesis in VSMC and found that doxorubicin treatment decreased the MKP-1 synthesis to below control levels in a dose dependent manner whether induced by heparin treatment or heparin-receptor antibody treatment. Heparin and antibody treatments resulted in between 30% and 50% decreases in serum induced ERK activity over a 30 minute time frame. The doxorubicin treated cells also retained ERK activity compared to heparin or antibody treated cells without doxorubicin. Again, the heparin-treated (and antibody-treated) cells levels of active ERK were significantly ($P<0.05$) different from serum activated cell active ERK levels. Together these data support a role for MKP-1 in heparin induced decreases in VSMC ERK activity. These studies were supported by PHS award HL54269.

The American Society for Cell Biology
Washington, D.C. (Dec 1, 2007)

Ultraviolet Spectroscopy of R Arae: An Active Interacting Binary Star

Phillip A. Reed (Lehigh University), George E. McCluskey, Jr. (Lehigh University)

The eclipsing, interacting binary star system R Arae (HD149730) is in a very active and very rare stage of its evolution. After receiving some attention in the 1980s and early 1990s, R Ara has unfortunately been neglected. A total of 124 high resolution ultraviolet spectra (taken by the IUE satellite) are analyzed. The data taken in September of 1989 are especially of interest considering that there are 36 consecutive spectra that span the entire 4.4-day orbital period. R Ara is believed to consist of a B9 primary and an unknown (early F to K ?) secondary, and is engulfed in a thick, nebulous plasma resulting from rapid mass flow within and from the system. Several light curves spanning the UV region were generated. In addition to continuum flux levels and radial velocities, the results of photometric and spectroscopic analyses are presented. These studies reveal clues about

the construction of this interacting binary (mass flow direction, high temperature regions, etc.) and help to identify its evolutionary status. There is a peculiar but consistent apparent "eclipse" past phase 0.5, as well as another consistent minimum at around first quadrature. Non-orbital gas motions are observed, with Mg II and Si IV exhibiting clear gas stream effects. R Ara is most likely at the end of its first phase of rapid mass transfer, on its way to becoming a classic Algol-type system.

211th Meeting of the American Astronomical Society
Austin, TX (Jan 8, 2008)

Loss of Endogenous Oncoprotein18/Stathmin in Mouse Embryo Fibroblasts Induces Changes in Tubulin Isoform Expression with Minimal Changes to Microtubule Dynamics

Danielle N. Ringhoff (Chemistry Department), Lynne Cassimeris (Department of Biological Sciences)

Keywords: Stathmin, Microtubules, Tubulin, RT-PCR

Op18/Stathmin is a ubiquitous microtubule (MT) destabilizing protein linked to cancer and cell health: Op18 is over-expressed in leukemias and its expression level correlates with breast cancer stage progression. We are using MEFs (mouse embryonic fibroblasts) WT (+/+), heterozygous (+/-), or knockout (-/-) for the Op18 gene to further characterize Op18's roles in MT polymerization and dynamics. MT polymer level and nucleation rate increased with loss of Op18. In contrast, loss of one or both copies of the Op18 gene results in surprisingly modest changes to MT dynamics. For example MT dynamicity, a measure of total tubulin addition and loss from MT ends, and catastrophe frequency were similar in all three lines. Since MT dynamics depend on tubulin (Tb) isotype composition (Panda et al., 1994), we used quantitative reverse transcription-PCR to measure differences in mRNA levels for each Tb isotype. The alpha-Tb I mRNA level did not change across genotypes, but protein level nearly doubled in the (-/-) line compared to WT. Cells (-/-) for Op18 also under-express mRNA for ß-Tb's II (20% less) and IV (36% less) and over-express ß-Tb III (78% more) compared to WT. This change in ß-Tb isotype expression is consistent with that observed in taxol-resistant breast cancer cells (Shalli et al., 2005). Other differentially regulated mRNAs include increases in alpha-Tb VII and VIII, and ß-Tb VII. We conclude that cells respond to loss of Op18 by changing the ratio of tubulin isoforms, allowing cells to maintain dynamic MT turnover. We hypothesize that it is changes to MT polymer content and specific Tb isoform expression, rather than changes to MT dynamics, that are responsible for Op18's role in cancer and cell survival. Thanks to Jutta Marzillier, Lehigh Genomics Facility, and G. Shyumyatsky, Rutgers University (mice). Funded by NIH.

ASCB 2007 Annual Meeting
Washington, D.C. (Dec 1, 2007)
American Society for Cell Biology

Inhibition of Gap Junction Intercellular Communication in Response to Activation of G-protein Coupled Receptors is Mediated via Gap Junction Internalization

Baker, SM (Lehigh University, Dept. of Biological Sciences), Segretain, D (Universite Paris 5), Falk, MM (Lehigh University, Dept. of Biological Sciences)

Communication between adjacent cells through gap junctions (GJs) occurs in nearly every tissue and is fundamental to coordinated cell behavior during development, differentiation, and tissue homeostasis. While both the regulation and complete inhibition of gap junction intercellular communication (GJIC) have been well documented, surprisingly little is known about how this modulation is actually achieved. GJ channels can open and close (gate) in response to physiological parameters, including intracellular pH, Ca^{2+} concentration, and connexin phosphorylation. However, GJIC could also be rapidly down-regulated through internalization of whole or portions of GJ plaques, as shown recently by our lab (Piehl et al., 2007, MBC 18, 337). Van Zeijl et al., (2007, JCB 177, 881) subsequently reported a rapid inhibition of Cx43-based GJIC in response to activation of the Gαq/PLCβ3-PIP2 hydrolysis pathway; however, they did not investigate how this inhibition is achieved. Here we report that activation of the Gαq/PLCβ3-PIP2 hydrolysis pathway by the inflammatory mediators, thrombin and endothelin (native Gαq agonists), or the wasp toxin mastoparan (a constitutive activator of Gαq) correlates with GJ internalization and concomitant inhibition of GJIC. Immunofluorescence imaging revealed that, in primary vascular endothelial cells (PAECs), in response to stimulation with these G-protein coupled receptor (GPCR) agonists, connexin-43 (Cx43) is rapidly internalized into intracellular GJ vesicles. Statistical analysis shows a significant decrease of GJs at the PM and a significant increase of intracellular vesicular Cx43 as compared to untreated controls. Activation of this signaling pathway results in a complete inhibition of GJIC measured by lucifer yellow scrape loading dye transfer. In controls treated with suramin (a Gαq antagonist) in the presence of thrombin, endothelin and mastoparan, GJIC is restored to wt levels as measured by Lucifer yellow scrape loading dye transfer. Ultrastructural analysis demonstrates the presence of numerous intracellular double-membrane vesicles exhibiting typical morphology of internalized GJs. These results indicate that inhibition of GJIC in response to activation of GPCRs is mediated via the internalization of GJs and suggest that inhibition of GJIC is a physiological function of GJ internalization.

47th Annual Meeting of the American Society for Cell Biology (ASCB)
Washington, D.C. (Dec 1, 2007)

An Examination of BiParental Care by Convict Cichlids: Sex Differences in the Retrieval of Offspring

Jennifer L. Snekser (Lehigh University), Murray Itzkowitz (Lehigh University)

Parents do not always share offspring care equally and each parent often has a special-

ized role. The most commonly observed sex-typical roles are defense by males and direct care of the offspring by females. In our study of convict cichlids (*Archocentrus nigrofasciatus*) we examined the behaviors of each parent when non-swimming young were displaced from the nest. Parental care was measured using retrieval of offspring and agonistic behaviors toward potential offspring predators. We found that males were more likely to retrieve young displaced far from the nest, while females retrieved young at closer distances. Additionally, although we found that both parents do attack the potential predator (a conspecific individual), retrieval behaviors did not change for either parent. We also examined retrieval behavior when one parent was removed and found that the remaining male or female parent was able to perform all behaviors associated with parental care. These preliminary studies suggest that while there is plasticity in parental behavior of convict cichlids, when together, parents often assume sex-typical roles.

Animal Behavior Society 44th Annual Meeting
Burlington, VT (Jul 21, 2007)
Animal Behavior Society

Solvation Controlled Luminescence of Sm(II) Complexes

Joseph Teprovich (Principle Researcher/Presenter), Edamana Prasad (Researcher), William Anderson (Researcher), Robert Flowers (Research Advisor)

Changes in solvation of samarium diiodide (SmI_2) can significantly alter the interaction between a ligand and metal. Addition of the appropriate "crown ether" to SmI_2 in acetonitrile not only stabilizes the ground state complex but also generates a highly luminescent complex. The advantage of direct excitation of lanthanide(II) complexes includes elimination of different deactivation pathways as well as the multi-step syntheses involved in preparing "antenna" ligands necessary for producing luminescent lanthanide(III) complexes. We demonstrate how controlling the coordination sphere of SmI_2 through changes in solvation induces remarkable changes both in the ground and excited states. By providing a chelating ligand for SmI_2 in a solvent incapable of displacing it significantly enhances the luminescent properties of Sm(II) by: 1.) encapsulating the metal through a strong metal-ligand interaction and 2) decreasing the frequency of solvent collision. This study led to the discovery of the longest reported excited-state lifetime for a Sm(II) complex in solution.

ACS- Middle Atlantic Regional Meeting
Ursinus College (May 16, 2007)
American Chemical Society

Blurred Borders: The Thin Rhetorical Line Between Audience and Text in Participatory Entertainment

Heather Urbanski (Lehigh University)

With the recent explosion of participatory digital media, rhetorical reality is quickly catching up with rhetorical theory. The idea of audience participation in texts is at least as old as Aristotle; now that theory is made manifest by digital media. We have long accepted a rhetorical view of reading as a transaction in which we re-create, or even re-write, a text each time we read it, but to-

day's "Digital Generation" students take that theory to an entirely new level, often actually creating the narratives as they experience them. While the impact of music downloading on contemporary views of intellectual property is well-documented, the Internet and other digital media offer a related realm that is just as rhetorically powerful: participatory entertainment. Under this rubric, we see such active digital engagement with popular culture as fan fiction, Massively Multiplayer Online Role-Playing Games (MMORPGs), and even Fantasy Football. As Jane Espenson, formerly a writer on Buffy, the Vampire Slayer, suggested at the 2006 World Science Fiction Convention, "there is a thin line between fan and pro" when it comes to Internet fandom, reflecting this rhetorical blurring between receiver and sender.

Today's digital technology allows an unprecedented variety of participatory entertainment to flourish, calling into question the traditional Rhetorical Triangle that separates sender, receiver, and message. Key to my argument is a typology of the Digital Generation, a description of the five main types of participation in popular entertainment, at the intersection of fandom, rhetoric, and technology where we find a growing cultural insistence on participatory entertainment as fans of all kinds demand to be actively involved. Of course, not all members of the Digital Generation have had the same experiences. Based on the cultural factors I discuss in this paper, however, we are likely to see one or more of the following types among our students: 1) The TV Fan; 2) The Sports Fan; 3) The Gamer; 4) The Filmmaker; and 5) The Chronicler.

Even when we aren't directly appropriating characters for our own online fiction, today's fans are not content to simply spend an hour in front of the television, receiving the writers' storylines, nor are we content to be passive spectators on Sundays, or even merely readers of the Sports Section. Instead, we blog, post on discussion forums, and run sophisticated Fantasy Football leagues, effectively blurring the boundaries between fan and writer/professional. This increasing desire to actively participate in our entertainment has significant rhetorical implications inextricably linked with the technology that makes it possible, implications that need to be considered by, among other institutions, First-Year Composition programs. Thus, my paper ends with a preliminary discussion of the impact of that blurring of rhetorical theory in the First-Year Composition classroom from pedagogical, theoretical, and cultural perspectives.

Penn State Conference on Rhetoric and Composition.
University Park, PA (Jul 8, 2007)

Stability of Membrane Associated α-L-Fucosidase in Human Sperm Cells

Jennifer J. Venditti (Lehigh University), Barry Bean (Lehigh University)

Two novel isoforms of α-L-fucosidase are present in human semen. Our lab has recently shown α-L-fucosidase is cryptically held within the acrosomal compartment and enriched within the sperm equatorial segment. Increase in enzyme activity is appar-

ent following permeabilization of the sperm plasma membrane. The occurrence of these novel isoforms is provocative. Sperm proteins potentially involved in sperm-egg interactions must maintain their functional integrity as they travel through the female reproductive tract. The goal of this project was to investigate the stability of membrane associated α-L-fucosidase in human sperm. Seminal plasma and Percoll® washed sperm cell populations were incubated for 72 hours at 37°C, 5% CO_2, 100% humidity. At various times during prolonged incubation, sperm cells were permeabilized with 0.01% Triton®X-100 and enzyme assays using the fluorogenic substrate 4-MU-fuc were performed to measure enzyme activity. Stability of seminal plasma and membrane associated α-L-fucosidase was determined. Seminal plasma α-L-fucosidase activity rapidly decreased within 24 hours incubation at 37°C, 5% CO_2, 100% humidity. Conversely, α-L-fucosidase activity from Percoll® washed cell populations persisted up to 72 hours incubation under the same conditions. Seminal plasma α-L-fucosidase is considerably less stable than the membrane associated isoform. Control assays containing 4-MU-fuc and HSM or 0.01% Triton®X-100 did not interfere with measurement of α-L-fucosidase activity. Data from these experiments support the notions that 1) membrane associated α-L-fucosidase is stable for extended periods of time, consistent with a possible role in sperm-egg interaction and 2) compartmentalization within the human sperm is key to preserving protein integrity.

32nd American Andrology Society Annual Meeting. Tampa, FL (Apr 23, 2007)

Functional Distribution of Hamster Sperm Associated α-L-fucosidase: a role in fertilization?

Jennifer J. Venditti (Lehigh University), Barry Bean (Lehigh University)

Sperm associated α-L-fucosidases have been identified in diverse organisms. The wide-spread distribution of this enzyme is consistent with the importance of carbohydrates during fertilization. Characterization of human sperm membrane associated α-L-fucosidase (SMALF) by our lab has demonstrated its cryptic subcellular distribution, with enrichment in the equatorial segment (Venditti et al. 2007). More recently we have reported SMALF's in situ stability with enzyme activity detectable up to 72 hours post ejaculation; consistent with the timeline for a successful fertilization event to occur. Previous studies provide direct evidence supporting roles for fucose containing polysaccharides and/or fucosidases during fertilization; however the roles and molecular mechanisms of SMALF remain to be defined. If SMALF is present in Syrian hamster sperm an in vitro model system to evaluate its role during stages of fertilization could be developed. Cauda epididymal contents (CEC) were collected from adult male Syrian hamsters and suspended in Human Sperm Medium (HSM). For capacitation, CEC were incubated in HSM supplemented with 3% BSA and 1 mM hypotaurine for 3 hours at 37°C, 5% CO_2. Acrosome reaction was induced by incubating capacitated cells with 10 μM BrA23187 ionophore for 30 minutes at 37°C, 5% CO_2. Enzyme assays using the fluorogenic substrate 4-MU-fuc

were performed as previously described (Venditti et al. 2007), with measurements recorded over a 30 minute time period. Enzymatic studies have revealed the presence of hamster sperm associated α-L-fucosidase. Activity was detectable in both the sperm pellet and soluble fraction. An increase in sperm associated α-L-fucosidase activity was evident following capacitation and acrosome induction. All hamster α-L-fucosidase activity was inhibitable by inclusion of L-fucose or deoxyfuoconjirimycin (DFJ) a known, specific competitive inhibitor. Western blot analysis showed detectable α-L-fucosidase bands comparable to those found in human semen. Preliminary IVF experiments using Syrian hamster sperm and oocytes have shown successful zona pellucida (ZP) binding and penetration by sperm, demonstrating a reasonable model system to evaluate the role of α-L-fucosidase during fertilization.

33rd American Society of Andrology Annual Meeting
Albuquerque, NM (Apr 14, 2008)

Nursery Rhymes and Children's Games in the Plays of Tina Howe

Sarah P. Albano Wascura (Easton Area School District and Lehigh University)

Keywords: Tina Howe, Absurdist, children

Tina Howe uses nursery rhymes and children's games much as parents use them: to amuse and distract, while attending to and instructing in the nuance and cadence of language. When separated from the rhythm and rhyme, the words of the nursery rhymes in One Shoe Off (the title itself being from a nursery rhyme) and Pride's Crossing depict fanciful and unnerving themes. Behind the rhythm and rhyme lie life's oddities. By attending to Howe's use of nursery rhymes and games in One Shoe Off and Pride's Crossing, her audience must return to their earliest language acquisition to contemplate what they have taken for granted, while being jolted into realizing they had accepted the surreal early in their lives, and examine how Howe's absurdist themes use those nursery rhymes as resonance for the study of language, its use in her plays, and in their own lives.

Howe's use of children's games in Birth and After Birth (musical chairs), Approaching Zanzibar (geography game), One Shoe Off (dress up and Concentration), Coastal Disturbances (shell game), Pride's Crossing (dress up and croquet) serves a similar purpose. These games instruct children in how to play by prescribed rules. Ironically, even with rules someone must win and someone must lose. Howe, as with the nursery rhymes, uses her absurdist skills to demonstrate how these childhood games contribute to the delusion that there are prescribed rules for life.

Horton Foote American Playwrights Conference
Baylor University, Waco Texas (Oct 26, 2007)

The Effect of Working Memory Load on Task Choice in Voluntary

Starla M. Weaver (Lehigh University), Catherine M. Arrington (Lehigh University)

The voluntary task switching (VTS) paradigm allows subjects to choose the specific task to be performed on each trial. Subjects are instructed to perform each task equally often and in a random order; however, they tend to show a repetition bias, performing fewer switches than would be expected in a random sequence. Lack of executive resources was assessed as a contributor to this repetition bias. A memory load manipulation was used to limit the executive resources available during VTS. Simple memory storage tasks, which required only the maintenance of memory letters, had no impact on VTS performance. However, a working memory load, which required the active manipulation of memory letters during VTS, differentially reduced the proportion of switches such that greater repetition bias was found under greater working memory loads. The availability of executive resources at the time of task performance appears to influence task choice.

48th Annual Meeting of the Psychonomic Society
Long Beach, CA (Nov 15, 2007)
Psychonomic Society

Position of Watershed Divides From Filtered Topography as an Indicator of Geodynamic Process: Using the Snake River and Greater Yellowstone Area as a Case Study

Karl W. Wegmann (Dept. of Earth & Environmental Sciences, Lehigh University), Dario Bilardello (Dept. of Earth & Environmental Sciences, Lehigh University), Brian D. Zurek (Dept. of Earth & Environmental Sciences, Lehigh University), Christine A. Regalla (Dept. of Earth & Environmental Sciences, Lehigh University), Jennifer L. Wollenberg (Dept. of Earth & Environmental Sciences, Lehigh University), Frank J. Pazzaglia (Dept. of Earth & Environmental Sciences, Lehigh University)

The spatial position of present-day and synthesized regional-scale drainage basin divides is an underutilized geomorphic metric that can be used to identify various overlapping geodynamic processes responsible for landscape evolution. In considering the stability or mobility of regional-scale drainage basin divides, two end-member scenarios may be envisioned. The first is where the divide remains spatially fixed over long periods of time during which an overthickened orogenic crustal root is passively consumed via erosional unloading and its isostatic response. The second is where divides actively migrate in response to dynamic mantle support of topography. Knowing that active drainage divide migration can be a key feature in distinguishing between passive and active geodynamic settings, we investigate drainage divide migration potential in the greater Yellowstone region (GYR), a geodynamically active area where the processes influencing the present-day topography are fairly well

defined. The GYR is an opportune location for this investigation because contrasting models have been proposed to explain the parabolic shape of elevated topography and active seismicity that outline the imprint of hypothesized hotspot activity. Drainage divides synthesized from topography filtered at 50, 100, and 150 km wavelengths within the GYR show that the locations of the actual and synthetic Snake River drainage divides are controlled by both dynamic and flexural mechanisms in the eastern GYR, but by flexural mechanisms only in the western GYR. The location of the actual divide deviates from its predicted position in the filtered topography where tectonic controls, such as active faults (e.g., Centennial and Teton faults), have uplifted large footwall blocks. Our results are consistent with the notion of a northeastward-propagating GYR topographic and seismic parabola, and suggest that adjacent Basin and Range extension follows from, rather than precedes, GYR dynamic topography. Furthermore, our analysis suggests that eastward migration of the Snake River drainage divide lags behind the continued northeastward propagation of high-standing topography associated with the Yellowstone geophysical anomaly by 1–2 m.y.

Geological Society of America Annual Meeting
Denver, CO (Oct 29, 2007)
Geological Society of America

Adsorption and Reaction of Cyclohexanone ($C_6H_{10}O$) on Pt(111)

Lindsey A. Welch (Lehigh University), Jooho Kim, Amelia Olivas, Bruce E. Koel

Adsorption of oxygen-containing cyclic hydrocarbons on transition-metal single-crystal surfaces is of considerable interest to practical heterogeneous catalytic reactions including hydrogenation/dehydrogenation, as well as hydrodeoxygenation reactions. We have investigated adsorption and reaction of cyclohexanone ($C_6H_{10}O$) on Pt(111) by using TPD, HREELS, AES, and LEED. The Pt(111) surface was very reactive towards chemisorbed cyclohexanone; adsorption in the monolayer was completely irreversible. We concluded that $C_6H_{10}O$ had a barrier to decomposition below 11 kcal/mol; $C_6H_{10}O$ decomposed to yield CO, H_2O, H_2 and CH_4. At least some C-O bond breaking occurred during decomposition to form H2O and leave some amount of carbon on the surface after TPD. HREELS data showed that some cyclohexanone decomposition occurred below 90 K; all cyclohexanone decomposition in the monolayer occurred by 200 K. Studies of the chemistry of $C_6H_{10}O$ on the (2x2) and ($\sqrt{3}$x$\sqrt{3}$)R30-Sn/Pt(111) surface alloys have been carried out and offer additional information about the adsorption and reaction of this molecule on alloyed surfaces.

2008 Spring Symposium
Seton Hall University, South Orange, NJ
(Mar 25, 2008)
Catalysis Society of Metropolitan New York

A fluvial record of active fault-propagation folding, Salsomaggiore anticline, northern Apennines, Italy

Luke F. Wilson (Lehigh University), Frank J. Pazzaglia (Lehigh University), David J. Anastasio (Lehigh University), Vincezo Picotti (University of Bologna), Jessica Wilson (Lehigh University), Alessio Ponza (University of Bologna)

The Salsomaggiore anticline in the northern Apennines is an actively growing fault-propagation fold that is flanked by a suite of early Middle Pleistocene (~0.8 Ma) to Recent fluvial terraces, which reveal a foreland-migrating wave of coupled incision and aggradation, interpreted to reflect the response of a fluvial system to progressive vertical and lateral fold-propagation. This ~10km-wavelength fold resides ~25 km hinterward of the modern structural front and exhibits a complex growth history extending back to at least the middle Miocene. Langhian-Messinian, marginal- to deep-marine clastics are folded about a NW-SE trending axis, record the majority of fold growth, and are superimposed by the Ligurian nappe and Pliocene-Recent deep-marine, marginal-marine, and fluvial strata with shallowing upward dips. Active growth is documented by fluvial terraces, recent seismicity, deflected stream channels, first-order stream gradients, and long-profile modeling.

1:10,000 scale mapping of terraces in the Stirone, Parola, and Taro River valleys which dissect the anticline, detailed measurements of strath elevations above modern stream channels, and limited radiocarbon and cosmogenic dating of terrace alluvium were undertaken in order to qualitatively and quantitatively characterize the record of recent fold-growth. The amount of incision since early Middle Pleistocene time generally increases from the Stirone (avg. 0.08 mm/yr), east to the Taro River (avg. 0.18 mm/yr), the pace of incision slowed in the middle Middle Pleistocene, and has increased since Late Pleistocene time. Unsteady incision rates likely reflect unsteady fold-growth. The increased amount of incision by the Taro River is attributed to a change in thrust-geometry and a corresponding increase in the amount of fault-slip and fold-propagation. Faster incision rates since Late Pleistocene time are probably largely apparent, reflecting a Holocene climate and anthropogenic land-use change that facilitate incision.

Geological Society of America Annual Meeting
Denver, CO (Oct 29, 2007) Geological Society of America

Diminished Mercury Emission From Water Surfaces by Duckweed (Lemna minor)

Jennifer L. Wollenberg (Lehigh University), Stephen C. Peters (Lehigh University)

Aquatic plants of the family Lemnaceae (generally referred to as duckweeds) are a widely distributed type of floating vegetation in freshwater systems. Under suitable conditions, duckweeds form a dense vegetative mat on the water surface, which reduces light penetration into the water column and decreases the amount of exposed water

surface. These two factors would be expected to reduce mercury emission by limiting a) direct photoreduction of Hg(II), b) indirect reduction via coupled DOC photooxidation-Hg(II) reduction, and c) gas diffusion across the water-air interface. Conversely, previous studies have demonstrated transpiration of Hg(0) by plants, so it is therefore possible that the floating vegetative mat would enhance emission via transpiration of mercury vapor. The purpose of this experiment was to determine whether duckweed limits mercury flux to the atmosphere by shading and the formation of a physical barrier to diffusion, or whether it enhances emission from aquatic systems via transpiration of Hg(0).

Deionized water was amended with mercury to achieve a final concentration of approximately 35 ng/L and allowed to equilibrate prior to the experiment. Experiments were conducted in rectangular polystyrene flux chambers with measured UV-B transmittance greater than 60% (spectral cutoff approximately 290 nm). Light was therefore able to penetrate the flux chamber from the sides as well as the top throughout the experiment, limiting the effect of shading by duckweed on the water surface. Flux chambers contained 8L of water with varying percent duckweed cover, and perforated plastic sheeting was used as an abiotic control. Exposures were conducted outside on days with little to no cloud cover. Real time mercury flux was measured using atomic absorption (Mercury Instruments UT-3000). Total solar and ultraviolet radiation, as well as a suite of meteorological parameters, were also measured. Results indicate that duckweed diminishes mercury emission from the water surface as compared to open water controls. Decreases in emission rate varied linearly with percent duckweed cover, with lower fluxes occurring at higher percent cover. Mercury flux in the duckweed treatments as compared to open water treatments decreased from 17% in the lowest percent cover treatment to 67% in the highest percent cover treatment. The observed decrease in mercury emission suggests that duckweed limits emission via the formation of a physical barrier to diffusion.

American Geophysical Union
San Francisco, CA (Dec 11, 2007)

Influence of Dissolved Organic carbon on the Viability and Infectivity of Cryptosporidum

Elizabeth A. Wolyniak (Lehigh University, Depatment of Earth and Environmental Science), Bruce R. Hargreaves (Lehigh University, Depatment of Earth and Environmental Science), Kristen L. Jellison (Lehigh University, Department of Civil and Environmental Engineering)

Keywords: Dissolved organic carbon (DOC), Cryptosporidium

Cryptosporidium is a group of waterborne protozoan parasites that cause significant gastrointestinal infection in humans. The challenges associated with pathogen removal from water supplies, combined with the lack of medical cure for this infection, makes environmental controls important to investigate. The infectivity of Cryptosporidium oocysts under different environmental conditions must be examined to determine the risk of human exposure and infection. The

research goal is to understand the direct effect of dissolved organic carbon (DOC) on the viability and infectivity of Cryptosporidium, as well as its indirect effects through other related environmental factors, including pH and UV radiation (UVR). This project examines direct and indirect effects of DOC on the viability and infectivity of Cryptosporidium using DAPI/PI staining, an excystation assay, and an in-vitro cell culture infectivity assay. The results show that both pH and DOC have significant impacts on Cryptosporidium viability and infectivity. This negative effect of DOC appears to be greater than the protective effect DOC has on oocysts by blocking damaging UVR. By identifying the influence of DOC and its interactions with other ecological factors on Cryptosporidium, watersheds at risk for supporting infectious oocysts can be identified and targeted for enhanced protection and/or water treatment.

30th Congress of the International Association of Theoretical and Applied Limnology (SIL 2007) Montreal, Quebec, Canada (Aug 14, 2007) International Association of Theoretical and Applied Limnology (SIL)

Shared sequences of the aromatase transcript in neurons and glia of the zebra finch brain.

Ryan D. Wynne (Lehigh University, Biological Sciences), Bradley J. Walters (Lehigh University, Biological Sciences), Peter V. Lovell (Oregon Health and Sciences University, Neurological Science Institute), Colin J. Saldanha (Lehigh University, Biological Sciences)

In many vertebrates, the P450 enzyme aromatase (CYP19a; E-synthase) is expressed in multiple tissues including the brain and gonad. In the zebra finch (Taeniopygia guttata), the aromatase gene is alternatively spliced in the 5' untranslated region (UTR) resulting in two known transcripts expressed preferentially in the brain (Exon 1a) and ovary (Exon 1b). These transcripts share identical sequences from the beginning of their protein translational start sites (Exon 2), the coding region (Exons 3-9) and through the 3' UTR (Exons 9-10). In addition to these constitutively expressed transcripts, an inducible aromatase is expressed in reactive glia following damage to the zebra finch neuropil. Inducible aromatase is detectable 6 hours following mechanical injury and persists for at least 6 weeks. Towards understanding the regulation and expression of glial aromatase, we hypothesized that inducible (glial) aromatase represents a novel transcript in the zebra finch. To test this hypothesis, we: (i) examined the upregulation of specific amplicons within the aromatase transcript following mechanical injury using quantitative PCR (qPCR), (ii) performed 5' and 3' rapid amplification of cDNA ends (RACE) from RNA extracted from injured and non-injured brain, (iii) ran northern blot analysis on injured and non-

injured telencephalic RNA and (iv) isolated the transcript in glial enriched cultures of the developing zebra finch telencephalon. qPCR revealed that while amplicons within Exon 1b were not upregulated following brain damage, amplicons within Exons 1a, 2, 8, 9 and 10 all increased in abundance in injured relative to non-injured telencephalon. 5' and 3' RACE studies failed to reveal novel 5'UTRs or 3'UTRs in injured telencephalon relative to uninjured brain. Northern blot analysis did not reveal any additional transcripts in the injured telencephalon relative to the non-injured telencephalon. Finally, primers of identical sequence amplified identical sized products from neuron- and glial-enriched cultures, suggesting that the aromatase transcript is similar in glia and neurons. This pattern of data suggests that the form of aromatase upregulated in glia following brain injury differs from that expressed in ovarian cells but is similar within the open reading frame to that expressed constitutively in neurons. We suggest that rather than being driven by a novel promoter, injury-induced aromatase transcription in glia may be actively silenced under constitutive conditions. Physiological changes following mechanical injury may result in the removal of this silencing mechanism in the zebra finch. Supported by: NINDS NS 047267.

Society for Neuroscience Annual Meeting
San Diego, CA (Nov 6, 2007)

Towards predicting streamflow based on SWE, melt timing, and topography in subarctic heterogeneous terrain

Fenglin Yan (Earth and Environmental Sciences, Lehigh University), Joan Ramage (Earth and Environmental Sciences, Lehigh University), Rose McKenney (Geosciences and Environmental Studies, Pacific Lutheran University)

Snowmelt onset date and snow water equivalent (SWE) are major factors that influence the spring runoff in high latitude, snow dominated basins. We combine AMSR-E L3 daily SWE from March to June 2003-2006, daily hydrological records from 3 sites on the Pelly and Ross Rivers, Yukon Territory [Pelly Crossing N62.82°, W136.58°, Faro N62.22°,W133.37°, and Ross River N61.99°,W132.37°], and a 1:250,000 DEM to develop a technique to predict streamflow in subarctic heterogeneous terrain. The AMSR-E L3 SWE algorithm was developed for global snow cover distributions; it is not optimized for heterogeneous terrain. Field data suggest that it underestimates the SWE in this area. We assume it represents the minimum SWE per pixel. SWE variations of the Pelly River basin (49,000 km2) and its two nested sub-basins (22,100 km2 and 7,250 km2), show that SWE had an apparent drop shortly after the snowmelt onset date determined from Tb and diurnal amplitude variations (DAV), which are also correlated with temperature change. During the early stage of snowmelt, high and low elevations have no significant SWE difference. After mid-April, the most intense melt period at

lower elevations, low elevation SWE drops far below high elevation SWE, which is just beginning the melt process. Initial melt and the drop in low elevation SWE likely cause the first small discharge peak in the hydrograph. When the SWE throughout the basin approaches 0 mm for more than 3 days, it is followed by the peak flow. The largest basin has an ~14 day lag between the SWE drop and the flow increase, while the smaller basins have an about 9 day lag. Snow distribution, melt, runoff, and the lag times vary due to diverse terrain and microclimate factors such as: forest cover, permafrost, temperature and precipitation. By combining topography, snow distribution and melt timing, we have developed an understanding of basin-specific stream discharge response to spring thaw. Passive microwave derived daily SWE data combined with terrain and melt timing have significant potential for constraining and predicting stream flow timing and magnitude during the melt season in subarctic regions.

2007 AGU Fall Meeting
San Francisco, CA (Dec 10, 2007)
American Geophysical Union

The Lambert W Function

Nicholas Zoller (Lehigh University Mathematics Department)

The Lambert W function is the inverse of the complex-valued function $f(x) = xe^x$. It has been studied since the 1700s by the likes of Johann Lambert, Leonhard Euler, and E.M. Wright, and it has applications to problems in calculus, dirfferential equations, graph theory, and computer science. This talk will present a survey of the most important properties of W and describe some of its applications in detail.

Fall meeting of the EPADEL Section of the Mathematical Association of America
Drexel University, Philadelphia, PA (Nov 10, 2007)
Eastern Pennsylvania and Delaware Section of the Mathematical Association of America

Abstracts from the College of Education

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Do Wireless Laptops Invite Instructional Change? A Multi-Case Study of High School Teachers' One-to-One Computing Implementations

Tonya B. Amankwatia (Lehigh University), M.J. Bishop (Lehigh University), Ward Mitchell Cates (Lehigh University)

Keywords: technology integration, teacher professional development, pedagogy,

As a part of a state grant, researchers conducted this year-long evaluation case study of an urban school district's laptop initiative during the 2006-2007 academic year. The laptops were implemented in 9th grade English Language Arts, Math, and Special Education Department classes. Comprised of three data collection points, this study triangulated observation, survey, and interview data gathered from various sources: principals, assistant principals, department chairs, teachers, and students.

Data suggested that teachers had started to revise their curricular plans to include greater wireless laptop use. Generally, teachers decreased their whole-group computer uses (one computer to the class) in favor of indidividual uses and cooperative group uses. The Special Education department employed small group use and individual use more frequently than other departments. The English Department utilized the Internet and word processing applications more. Students indicated in survey responses that they enjoy using technology in their lessons and teachers indicated in their survey responses that technology can enhance instruction.

Further, teachers' first-year use of laptops

centered on their own classroom preparation, communication and administrative uses at baseline measure before extending to regular classroom use by students. For the most part, teachers used tool software, namely word processing and presentation software, more often than other types such as production software used to create movies, graphic, or audio products. None of the findings are surprising in light of current one-to-one research literature.

Based on the data, researchers affirmed that the acquisition of laptops does very little by itself to change pedagogy unless other environmental conditions and teacher beliefs are in place. Data findings suggest that the degree to which teachers employed laptops was affected by the school culture, pedagogical beliefs about technology's role in education, teachers' perceived self efficacy, computer efficacy, and commitment of project-level and executive-level administrators.

Association for Educational Communications and Technology
Anaheim, CA (Oct 23, 2007)

What Parents Prefer In Parent Management Training: An Ethnically Diverse Perspective

Ernesto Barnabas (Lehigh University, Bethlehem, PA), Patricia H. Manz (Lehigh University, Bethlehem, PA), Brook Sawyer (Thomas Jefferson University, Philadelphia, PA)

The purpose of this poster session is to describe the use of a partnership-based approach to investigate the preferred components of Parent Management Training (PMT) programs among families from low-income and ethnic minority cultures. Preferences will be evaluated using a quantitative Q-sort method with primary caregivers from low-income areas of the Northeastern United States. Caregiver preferences of PMT components among low-income and ethnic minority families will be presented and discussed. School Psychologists involved in parent education interventions will learn more about culturally relevant priorities in PMT and gain information that could increase the effectiveness of their practice with high-risk, vulnerable families.

National Association of School Psychologists
New Orleans, LA (Feb 6, 2008)
National Association of School Psychologists

A Path Analysis of the Relationships between Social Problem Solving and White Racial Identity

Amanda Carr, M.Ed. (Lehigh University), Grace Caskie, Ph.D. (Lehigh University)

Keywords: white racial identity, social problem solving, path analysis

Introduction

Diversity on U.S. college campuses is increasing, with the enrollment of students of color growing by over 48% in the last decade (McTighe, Garcia, Hudgins, Nettles, Sedlack, & Smith,, 1999). Consequently, White college students are increasingly interacting with individuals from different racial groups. In addition, identity development becomes particularly relevant during this period (Erikson, 1968). As such, White college students' psychological orientation towards racial group membership (i.e., White racial identity) may become salient as students begin to explore their reactions to societal dynamics of racial oppression (Carter, 1997; Helms, 1996).

The development of college students' White racial identity may be further influenced by social problem solving appraisals, the process of coping with challenges that occur in the natural environment or "real world" (D'Zurilla & Nezu, 1982). In fact, social problem solving and White racial identity share a central theoretical component: both contain advanced dimensions/statuses characterized by cognitive flexibility and adaptability in social situations (Durlak, 1983; Helms, 1995). Mercer and Cunningham (2003) claim that White racial identity may reflect either adaptive or maladaptive coping mechanisms that affect how the stress of social interactions with racially diverse individuals is resolved. Despite common conceptual features, only one known study has examined the relationship between social problem solving and racial identity, using a sample of African American college students (Neville, Heppner, & Wang, 1997). Results indicated that students with greater endorsement of pro-Black/anti-White sentiments (Immersion/Emersion attitudes) tended to have lower problem-solving appraisal, lacking confidence and avoiding problems. On the other hand, higher Internalization attitudes in the most advanced status were associated with greater problem solving appraisal. Nevertheless, no study to date has examined the relationship between social problem solving and racial identity for White college students. The current study examined relationships between social problem solving appraisals and White racial identity. We hypothesized: (1) Positive Problem Orientation (PPO) and Rational Problem Solving (RPS), both of which are adaptive and facilitative dimensions, would positively predict the advanced statuses of White racial identity: Immersion/Emersion and Autonomy, (2) Negative Problem Orientation (NPO), Impulsivity/Carelessness Style (ICS), and Avoidance Style (AS), which are considered maladaptive and inhibitive dimensions of problem-solving, would negatively predict Autonomy status, (3) NPO, ICS, and AS would positively predict Disintegration and Reintegration statuses, both characterized by a belief in White racial superiority, (4) RPS would negatively predict Disintegration status, representing feelings of guilt and helplessness and an avoidance of Black people. Also, because white racial identity statuses represent a developmentally progressive order, we hypothesized that scores on earlier White racial identity statuses would be related to scores on adjacent higher statuses.

Method

Participants included 160 White undergraduate students (M=63, F=97) at a predominantly White university in the northeastern United States. In addition, 41% (n=66) of the sample were freshman, 23% (n=37) sophomores, 20% (n=32) juniors, and 16% (n=25) seniors. Participants were recruited through campus-wide advertising and from sociology and engineering classes. Participants completed: (a) a demographic form, (b) Social Problem Solving Inventory – Revised (SPSI-R; D'Zurilla, Nezu, & Maydeu-Olivares, 2002), and (c) White Racial Identity Attitudes Scale (WRIAS; Helms, 1995; Helms & Carter, 1990). The SPSI-R has five subscales: Positive Problem Orientation, Negative Problem Orientation, Rational Problem Solving, Impulsivity/Carelessness Style, and Avoidance Style. The WRIAS includes six subscales, representing six statuses of racial identity development:

Contact, Disintegration, and Reintegration, representing the movements away from racism; and Pseudo-Independence, Immersion-Emersion, and Autonomy, characterized by the eventual formation of a non-racist White racial identity.

Results

Path analysis was used to test a model incorporating the relationships hypothesized above. Results indicated the model adequately fit the data (χ^2(16, N=160)=59.982, p<.001, GFI=.935, CFI=.923). Higher RPS was significantly related to lower Disintegration (β=-.062, p=.019), whereas higher AS was significantly related to higher Disintegration (β=.228, p=.012). Higher NPO was significantly related to lower Autonomy (β=-.121, p=.016). In addition, all earlier White racial identity statuses were significantly related to adjacent higher statuses: (a) Disintegration significantly predicted Reintegration (β=.877, p<.001), (b) Reintegration significantly predicted lower Pseudo-Independence (β=-.196, p<.001), (c) Pseudo-Independence significantly predicted Immersion-Emersion (β=.562, p<.001) and Autonomy (β=.395, p<.001), and (d) Immersion-Emersion was significantly related to Autonomy (β=.186, p<.001).

Conclusions

Several of the hypothesized relationships between social problem solving appraisals and White racial identity were found in this study. As hypothesized, higher NPO scores were significantly related to lower scores on Autonomy status, indicating that individuals who tend to feel anxiety and anger and present negative attributions to life's challenges also tend to be less likely to be committed to working for change, or seek out contact with different racial groups and experience that contact as mutually enriching. Also, our hypothesis that AS and Disintegration were related was supported, similar to findings by Neville et al. (1997). The hypothesized relationship between higher RPS scores and lower Disintegration was supported, implying that individuals who tend to avoid problems also tend to feel guilt or helplessness when becoming aware of racial differences and as a result deny that racism exists and avoid contact with people of color. In addition, individuals who practice systematic, efficacious use of problem solving strategies are less likely to exhibit these feelings, cognitions, and behaviors. Further, scores on earlier White racial identity statuses were significantly related to scores on adjacent higher statuses, supporting the principle that statuses are presented in an evolving, ascending order. While not all hypotheses were supported, these results extend previous research by suggesting a theoretical link between social problem solving and racial identity for White college students (Neville et al., 1997). As Mercer and Cunningham (2003) proposed, White racial identity may reflect adaptive or maladaptive coping mechanisms. In addition, the findings present practical implications for counseling psychologists. Social problem solving training may be incorporated into White racial identity development programs for college students, thereby promoting adaptability to new social demands, healthy interactions with others, and the development of a flexible view of the world, one's own racial group, and that of others.

115th Annual Convention of the American Psychological Association
San Francisco CA (Aug 18, 2007)

A Multi-Component Goal-Setting Intervention to Improve Children's Mathematics Skills

Jaime L. Benson, M.Ed. (Lehigh University), Edward S. Shapiro, Ph.D. (Lehigh University)

The current study examined the effects of goal setting on an intervention utilizing incremental rehearsal and performance feedback to teach multiplication facts to students with emotional and behavioral disorders using a multiple-baseline design across participants. Research indicates that drill models and performance feedback are effective for addressing mathematical difficulties. Further, the use of self-set goals is one way to enhance task performance. Results showed mild improvements in fluency for all three participants during performance feedback and incremental rehearsal, while two participants continued this growth during the goal-setting intervention. Two of the three participants demonstrated increases in their rate of improvement with the addition of the goal setting component to the intervention.

National Assocation of School Psychologists
New Orleans, Louisiana (Feb 5, 2008)

Design Strategies for Enhancing Social Connectedness in Online Learning: An Instructor's Guide to "E-mmediacy"

Patricia J. Slagter van Tryon (Lehigh University)

Keywords: Online Learning,Instructional Strategies, Social Connectedness, Technology

Despite the unprecedented growth and availability of Web-based instruction and the great promise of "any time/any place learning," it appears that higher than average attrition rates remain an issue for online learning (King, 2002). Students in online courses report missing the interpersonal interactions they more typically have with each other and with their instructors in face-to-face courses (Reisetter & Boris, 2004). Similarly, instructors report feeling out of touch with their students (Willis & Dickinson, 1997). Zielinski (2000) contended that this "disconnectedness" is directly related to the lack of immediate feedback and social cues that are so prevalent among classroom-group members in traditional courses.

Thus, a key problem with Web-based instruction may be the extent to which it fails to produce the sense of "social connectedness" often highly valued as a part of teaching and learning in face-to-face instruction (Jasma & Koper, 1999). It seems, however, that many college and university faculty may begin teaching online with little understanding of why social connectedness is important to learning, how the technology impedes learners' feelings of social connectedness, or what can be done to enhance social connectedness in online learning environments (Young, 2002).

Proponents of social learning theory argue that successful learning takes place in an environment where individuals can construct ideas, culture, histories, and meaning as the result of ongoing social interactions and collaborative functioning (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991). Within that social structure, learners gain a sense of belonging through interpersonal interactions and collaborative meaning-making. Moreover, it is this group structure that supplies the conduit for successful interaction and communication necessary

for learning. According to Forsyth (1999), social structure in the classroom develops naturally beginning with initial assessments of group members' status, development over time of group norms, and eventual differentiation of the roles members will assume within a group.

Johnson and Johnson (1994) argued that, when group social structure develops successfully, a class functions more effectively in meeting its learning goal. Apparently, group social structure affords students a knowable "context" to facilitate peer-to-peer interactions and decrease certain social stresses –in turn, freeing up cognitive resources for learning that would otherwise be allocated to negotiating one's position in the group (Patterson,1996). According to Taifel (1981), however, a group's ability to stimulate individual performance and to assess activity on group tasks depends to some extent on physical presence. What changes when learners attempt to develop group structure in an online environment instead?

For one, the strategies used in face-to-face classes often are not feasible in an online learning environment where many "normal" sensory communication channels are unavailable. Instead, online learners communicate at much greater distances through unfamiliar channels that introduce new and unexpected sorts of communication noise –from technical glitches to ambiguous text-based messages. In addition, these channels can obstruct senders' and receivers' usual methods for using feedback to remediate communication problems that arise while the group's social structure is being established. This, in turn, impedes learners' feelings of social connectedness with the group (Kagan, 1992), which, as discussed above, may have implications for learning.

Given the importance of group social structure development for learning and the barriers to instructional communication posed by the technology, instructors may need to re-examine the way they design their online learning environments with an eye toward facilitating status assessments, norms development, and role differentiation. This likely entails incorporating strategies to replace traditional instructional communication redundancies that enhance feelings of social connectedness and are missing from the online learning environment.

How might an instructor design the learning environment to overcome technological barriers to social connectedness? Research examining strategies for creating social connectedness in the classroom dates back to the late 1960s when Mehrabian (1969) defined immediacy strategies as the verbal and nonverbal interpersonal communication behaviors people use to reduce the perception of physical distance between them. Since that time, researchers have found that instructional immediacy –an instructor's use of engaging eye contact, gestures, smiles, humor, personal experiences, praise, and personal recognition– may be linked to students' positive feelings about courses and instructors, motivation to learn, achievement, and perception of control (Wilson & Taylor, 2001). Immediacy strategies may be even more important in e-learning environments where students and instructors are separated by time and space (Freitas, Meyers, & Avtgis, 1998). Studies by Hackman and Walker (1990, 1995) and Guererro and Miller (1998), for example, indicate that in televised and videotaped distance courses, immediacy behaviors may positively influence learning and increase students' overall satisfaction.

However, while it appears that online immediacy –or e-mmediacy-- may play an important role in social connectedness and the development of social structure, instructors will find little guidance on how to incorporate e-mmediacy strategies. Many of the books available to assist online instructors in the design and development of online courses focus primarily on the technological aspects of course building and maintenance, but not on the social connectedness problems instructors are likely to encounter or the technological barriers they will face when attempting to maintain social connectedness online (Hart, 2002). Others discuss the importance of social interaction in online learning, but do not supply specific affective strategies for facilitating these interactions (Rovai & Lucking, 2003). Additionally, there are no instruments presently available to measure "e-mmediacy" or its potential to support the development of group structure in online learning environments. It appears there is a need for more practical guidance and tools for incorporating and assessing e-mmediacy strategies for the development of group social structure in online learning environments.

This, therefore, led to the presenter's research. In this session she will present strategies from her theory-to-practice instructor's guide for incorporating e-mmediacy strategies in online learning. Four broad categories of approaches to design and implementation of online courses and their corresponding e-mmediacy strategies will be discussed: 1) consistent interaction; 2) dictating pace; 3) comprehensive technical support; and 4) instructor competencies. The researcher will then demonstrate popular technologies and methods used for enhancing e-mmediacy in online learning environments such as podcasting techniques and simple video editing and posting.

Association for Educational Communications and Technology Annual Convention
Anaheim, Calafornia (Oct 23, 2007)

Helping Students with Chronic Illness: The Importance of School-based Data

David Wodrich (Arizona State University), Kelly Daley (Arizona State University), Christy M. Walcott (East Carolina University), Ravit R. Stein (Lehigh University), Jilda A. Hodges (Lehigh University), Patricia H. Manz (Lehigh University), Tiffany Chenneville (University of South Florida)

Keywords: School psychology, chronic illness

This symposium explores the importance of including school-based data when researching or addressing health issues because clinic-based research often ignores classroom variables and teacher concerns. Presentation of four papers is the basis for discussion about pediatric school psychology intervention and prevention. Presenters summarize key points from their research, with projects investigating type 1 diabetes mellitus, childhood cancer, asthma, and HIV. Discussion will highlight the importance of including educational variables when examining health-related issues. Attendees will understand the limitations of clinic-based data in its application to school-based intervention while learning specific approaches to address chronic conditions. They will also hear about future directions of pediatric school psychology as a subspecialty.

Annual Meeting of the National Association of School Psychologistst.
New Orleans, LA (Feb 7, 2008)
National Association of School Psychologists

Abstracts from the P.C. Rossin College of Engineering and Applied Science

The P.C. Rossin College of Engineering and Applied Science at Lehigh University is a national leader in engineering research and education. Not only does the college have long standing reputation in core engineering disciplines, it is making major contributions to rapidly emerging areas as well.

The College's educational philosophy is founded upon inquiry-based learning – and integration of experiential learning, independent research endeavors, and instructional teaching. Our faculty shares a passionate commitment to teaching, mentoring, and creating groundbreaking new programs; combined with our state-of-the-art teaching and research facilities, this forms the basis of a unique and dynamic learning environment.

Lehigh's engineering research programs are assembled into intellectually coherent clusters that support a host of multidisciplinary research endeavors. Building on Lehigh's reputation in microscopy, microelectronics, surface science, energy, and structures, faculty-led advisory councils foster high-impact research and academic development in these broad areas:

Bio: Bio, Environmental, and Molecular Engineering
Nano: Nanotechnology and Applications
Systems: Complex Engineering and Information Systems

Faculty and students collaborate easily within these clusters and across traditional boundaries on projects that have applications in health care, the environment, energy, structural safety, and high performance computing, and partner with colleagues and peers in business, education, and the arts and sciences.

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Finite Element Simulation of Electromigration Cracking

Bora Baloglu (Mechanical Engineering and Mechanics, Lehigh University), Professor Herman F. Nied (Mechanical Engineering and Mechanics, Lehigh Univeristy)

Electromigration is one of the major problems that limits the reliability of high density microelectronics. Since microelectronic packages are expected to function reliably for long periods of time, it is crucial that numerical simulations be developed to aid in comprehensive package design. Electromigration is the transport of atoms in a conducting material due to momentum transfer from flowing electrons which leads to a failure in metal structures with high current densities. The presence of crack like defects in the conduction path accelerates the time to failure. The purpose of this paper is to describe a finite element formulation of the coupled stress-diffusion behavior that is observed in electromigration phenomenon. Specialized enriched crack tip elements, which simplify the fracture and reliability analyses, are used in this finite element formulation. A unique aspect of this work is the incorporation of defects (cracks) in the finite element models, which permits the direct calculation of relevant fracture parameters, like strain energy release rate, stress intensity factors and crack opening displacements.

TECHCON 2007
Austin, Texas (Sep 10, 2007)
Semiconductor Research Corporation (SRC)

Materials for Reversible High Temperature Chemisorption of CO_2

Michael G. Beaver (Lehigh University), Ki Bong Lee (Lehigh University), Shivaji Sircar (Lehigh University), Hugo Caram (Lehigh University)

Results of experimental tests into the equilibrium and column dynamic data for the chemisorption of CO_2 on two materials has identified the materials as potential candidates for the capture of CO_2. The first of the materials is a K_2CO_3 - promoted hydrotalcite that displays good sorption capacity in 400-500 °C range. The second is a Na_2O -promoted alumina that has shown good sorption capacity in 250-400 °C temperature range. The two materials both exhibited Langmuirian behavior in the low pressure region, but deviated substantially in higher pressure regions. A new analytical model that simultaneously accounts for Langmuirian chemisorption and an additional surface complexation reaction between gaseous and sorbed CO_2 has been proposed to describe the measured equilibrium data for both materials. Experimental breakthrough tests showed fast kinetics and narrow mass transfer zones for CO_2 adsorption. The isosteric heats of chemisorption and heats of additional complexation reaction on both materials were estimated to be low, indicating that desorption of CO_2 from both materials could be achieved with relative ease. Tests have confirmed that both materials show stable sorption capacity after several sorption-desorption cycles. These characteristics make them attractive candidates for use in cyclic processes for the capture of CO_2. The Na_2O promoted alumina shows promise as a candidate for capture of CO_2 from flue gas of a coal fired power plant, while the K_2CO_3 promoted hydrotalcite will be a better candidate for the Sorption Enhanced Reaction process to simultaneously produce fuel cell grade H_2 and high purity CO_2 at feed gas pressure.

American Institute of Chemical Engineering Annual Fall Meeting
Salt Lake City, Utah (Nov 6, 2008)
American Institute of Chemical Engineering

Grain Growth Kinetics in Co-doped Alumina's: Relation with Grain Boundary Complexions

Shantanu Behera (Lehigh University), Martin Harmer (Lehigh University)

Keywords: Grain boundary complexions, EXAFS, boundary mobility

It is being gradually recognized that there are various types of dopant/impurity segregation induced grain boundary complexions in polycrystalline oxides; starting from an ordered segregation of dopants, going through a series of changes in decreasing crystalline order and finally forming an intergranular glassy film. It is also understood that the formation and stability of these boundary complexions are functions of thermodynamic variables like dopant concentration, grain boundary energy and temperature etc. In a series of grain growth kinetics experiments in our laboratory, ultrahigh purity polycrystalline alumina doped with controlled amounts of Ca, Si, Nd, Y, La etc. has shown discontinuities in the grain boundary mobility that could be linked to the various types of grain boundary complexions observed. In alumina co-doped with

Y and Si, the boundary mobility increases by orders of magnitude as compared to alumina doped with Y alone. The present work aims to discuss the outcomes of detailed boundary mobility measurements in alumina co-doped with Cu-Ti, Zr-Si and Y-Si under similar conditions over a wide temperature range and relate the boundary mobility values to various grain boundary complexions.

International Conference on Advanced Ceramics and Composites
Daytona Beach, FL (Jan 27, 2008)
The American Ceramic Society

Study of Monomer Droplets in Miniemulsions

Megan B. Casey (Lehigh University), E. David Sudol (Lehigh University), Mohamed S. El-Aasser (Lehigh University)

Keywords: miniemulsion, droplet size distribution, acoustic attenuation spectroscopy, colloid

Miniemulsion technology offers the ability to produce latexes that cannot be prepared via conventional methods, such as those using highly water-insoluble monomers, or encapsulates of pigments, oils, and polymers. Fundamental understanding of miniemulsions has been hindered by the inability to measure and monitor their droplet size distribution (DSD), which is thought to lie in the range of 50 to 500 nm. The goals of this work are to characterize the DSD of miniemulsions, understand the mechanisms that determine it, and seek methods to control it.

Acoustic attenuation spectroscopy (AAS) was investigated to determine its feasibility for miniemulsion DSD characterization. Testing has shown promise, but dilution level, broadness of droplet size distribution, and surfactant concentration affect the results. In order to compare AAS with other sizing techniques, the DSD of a hexadecane miniemulsion was characterized by AAS as well as dynamic light scattering (DLS), capillary hydrodynamic fractionation (CHDF), and surfactant titration. There was fairly good agreement between these very different methods.

An indirect method of observing droplet size was explored. Styrene miniemulsions with various amounts of dissolved polystyrene were prepared and their DSDs characterized. After evaporation of the styrene, the DSD was then reanalyzed. Assuming that the composition of each droplet was initially the same, and that evaporation removed only styrene and left the polymer originally present in the droplet intact, the initial DSD could be inferred. However, the droplet size changed with the amount of dissolved polymer, indicating Ostwald ripening altered the initial composition of the droplets significantly.

In order to prevent droplets from degrading during analysis via conventional CHDF, the eluent must be saturated with monomer. A CHDF instrument was modified for use with styrene-saturated eluent to analyze styrene miniemulsions. The average droplet size was found to increase with time, but more slowly with higher costabilizer content, as expected. Similar results were obtained by AAS and surfactant titration.

The extent of Ostwald ripening in styrene miniemulsions was observed by centrifugation, imaging of the layers via optical microscopy, and determination of the droplet composition in each layer via GC. It was found that the co-

stabilizer, hexadecane, becomes concentrated in the small droplets while it is diluted in large droplets, as expected, but to a surprisingly high extent. No monomer separation occurred after centrifugation of an octadecyl methacrylate miniemulsion, indicating little or no Ostwald ripening as expected due to the extremely low water solubility of this monomer.

Gordon Research Conference
Tilton, NH (Jun 24, 2007)
Gordon Research Conferences

Fluid-Structure Analysis of Cellular Deformation and Detachment during Airway Reopening

H.L. Dailey (Lehigh University), S.N. Ghadiali (Lehigh University)

Pathological conditions such as pneumonia and sepsis can lead to acute respiratory distress syndrome (ARDS), a condition characterized by fluid accumulation in the distal airways. Ventilation of ARDS patients produces microbubbles which reopen fluid-occluded airways and may deform, injure and/or detach epithelial cells (EpC) from the airway wall. Although in-vitro systems can mimic airway reopening conditions, current visualization techniques cannot quantify cell deformation and detachment during microbubble flows. To investigate these processes we developed 3D finite element models of EpC under airway reopening conditions. These models utilized in-vitro confocal microscopy to specify cellular morphology and optical tweezer measurements to specify the EpC's viscoelastic properties. Boundary element solutions were used to specify hydrodynamic loading on the EpC and adhesion properties were based on a steered molecular dynamic (SMD) simulation of the integrin-collagen complex. We also developed a hybrid boundary element/finite element method to investigate the effect of cell deformability on the hydrodynamic stresses generated by the air-liquid interface. Results indicate that both cytoskeletal and membrane mechanical properties can influence the risk of injury and detachment. These results have helped explain counter-intuitive experimental data and may lead to the development of improved treatments for ARDS. HLD is a NSF Graduate Research Fellow and SNG is a Parker B. Francis Fellow in Pulmonary Research.

Biomedical Engineering Society Annual Fall Meeting
Los Angeles, CA (Sep 26, 2007)

Surface Characterization of a Synergistic Pt-Rh/γ-Al_2O_3 Catalyst Through NO Adsorption

Paul S. Dimick (Lehigh University), John L. Kross Jr. (Lehigh University), Richard G. Herman (Lehigh University), Harvey G. Stenger (Lehigh University), Charles E. Lyman (Lehigh University)

Effective bimetallic catalysts often exhibit synergy. Synergy is defined as the bimetallic catalyst being more active and/or selective than either of its constituent metals. The activity and selectivity of bimetallic catalysts is dependent upon their particle surface compositions which in turn is a function of individual particle composition, pretreatment conditions, and other factors. This study compares the activity and surface composition of a Pt(95%)-Rh(5%)/γ-Al_2O_3 catalyst (95/5) to Pt/γ-Al_2O_3, Rh/γ-Al_2O_3, and γ-Al_2O_3. Reacting NO and H2 over each of the catalysts resulted in the following order of relative NO reduction activity 95/5 > Pt/γ-Al_2O_3

> $Rh/\gamma\text{-}Al_2O_3$ >> Al_2O_3. The maximum synergistic performance of 95/5, a five-fold increase over the activity of $Pt/\gamma\text{-}Al_2O_3$, was obtained after conditioning the catalyst by reacting it at 250°C for 10 h, and the synergistic performance of 95/5 was unaffected by a 24 h reduction at 300°C. The surface composition of the prepared catalysts was investigated with in-situ FTIR spectroscopy at 100°C, 150°C and 200°C using NO as a probe molecule. The obtained spectra indicate that both Pt and Rh are present on the surface of the synergistic 95/5 catalyst. The amount of Rh on the catalyst surface increased as a function of NO adsorption temperature. Rh present on the surface of the alloy nanoparticles was in a reduced state at 150°C and 200°C, while on a monometallic $Rh/\gamma\text{-}Al_2O_3$ catalyst some of Rh present was partially oxidized. Analytical electron microscopy has been used to show that the metals on the surface of synergistic Pt-Rh bimetallics exist as a single phase of Pt-rich Pt-Rh alloy nanoparticles, while both Pt-rich and Rh-rich alloy phases are present on non-synergistic Pt-Rh bimetallics.

Catalysis Society of Metropolitan New York Spring Symposium
ExxonMobil Research & Engineering Company, Annandale, New Jersey (Mar 21, 2007)
Catalysis Society of Metropolitan New York

Supervisory Control of a Multi-Echelon Supply Chain: Structure, Modeling, Performance Measures and System Analysis for Inter-organizational Control.

Julie Drzymalski (Lehigh University), N.G. Odrey (Lehigh University)

Petri nets are frequently utilized to model system dynamics due to their ability to handle concurrencies and sequential dependence. In this paper a portion of the Supply Chain Operations Reference (SCOR) model has been extracted and modeled using Petri nets for the purpose of exerting supervisory control upon a multi-echelon supply chain. The activities of source, make and deliver, inherent in the SCOR model form the basis of the representation of the Petri Net model for each echelon considered in the supply chain model. A supervisor is placed above the base model of each echelon to exert local constraints. These constraints are at the tactical and operational levels. An Enterprise level SCM is added which enforces additional constraints consisting of long term planning goals at the strategic level. Invariant analysis is used to create the supervisors. Performance measures of the supply chain as one entity are formulated to determine the effectiveness of any partnership. An efficient method for finding the current state of the system is developed which is used to determine the performance measures of each echelon. This paper presents an approach to the overall structure and Petri Net modeling for the system and is intended to extend the use of supervisory control from a shop-floor level to an inter-organizational facility and enterprise level.

The 17th International Conference on Flexible Automation and Intelligent Manufacturing Philadelphia, PA (Jun 18, 2007)

Consumption And Granular Flow In A Vibro-Fluidized Stirred Granular Bed

K. J. Ford (Lehigh Univeristy), J. F. Gilchrist (Lehigh Univeristy), H. S. Caram (Lehigh Univeristy)

This work examines the behavior of a deep granular bed subject to simultaneous vertical vibration and stirring. The power necessary

to stir a 5.6 cm diameter and 20 cm deep granular bed of 150 micron glass beads using a 4-blade vane impeller was measured over a wide range of forcing conditions. Impeller rotation rates from 0 - 1000 rpms and vibration accelerations in the range $0 \leq \Gamma = \omega^2 a/g \leq 4.0$ were explored. Both the power required for stirring and vibration were recorded. Sharp changes in vane power draw indicate flow transitions from dense granular flow to vibro-fluidized flow at a critical acceleration (Γ_c). The total power profile (vane plus vibration power) demonstrates a minimum just above the critical acceleration. Progressive increases or decreases n both vane speed and Γ independently show hysteresis as the flow bifurcates between two primary states of dense granular flow and loose-packed, vibrofluidized behavior. These observations are compared to those found in fluidized systems and flows generated in high-shear granulators.

AIChE Annual Meeting
Salt Lake City, UT (Nov 7, 2007)
American Institute of Chemical Engineers

Design of unidirectional subwavelength slit coupler for THz surface plasmons

Qiaoqiang Gan (Lehigh University), Zhan Fu (Lehigh University), Yujie Ding (Lehigh University), Fil Bartoli (Lehigh University)

In this paper, we demonstrate a unidirectional subwavelength slit coupler at THz frequencies by using two-dimensional finite difference time domain (FDTD) modeling. The near-field light emitted from the narrow slit serves as a subwavelength-scaled excitation source. By placing a particular grating structure on one side of the slit, the light could be guided in only one direction. This unidirectional subwavelength slit coupler is amenable to incorporation into optical integrated circuits at THz frequencies.

7th International Conference on Numerical Simulation of optoelectronic Devices
Newark, Delaware (Sep 24, 2007)

Shear-induced migration of suspensions in 3D microfluidic geometries

Changbao Gao (Lehigh University), James F. Gilchrist (Lehigh University)

We investigated shear-induced migration of 1 micron Brownian particles in 1D, 2D, 3D steady microfluidic flows generated in straight, herringbone, and staggered herringbone channels respectively. The transverse flows induced by recessed herringbone structures in the top of the channels interplay with particle migration to the low shear regions of the pressure-driven flow. Using high-speed confocal laser scanning microscopy, we were able to image directly flowing particles inside the channels. Moreover, we located the 3D positions for each particle and obtained 2D concentration and 2D velocity profiles to better understand of the effects from the underlying flow topology, colloidal hydrodynamics, and Reynolds and Péclet number on particle migration.

81st Colloid & Surface Science Symposium.
ACS Division of Colloid and Surface Science.
University of Delaware (Jun 26, 2007)

Power Consumption And Granular Flow In A Vibro-Fluidized Stirred Granular Bed

J. F. Gilchrist (Lehigh Univeristy), K. J. Ford (Lehigh Univeristy), H. S. Caram (Lehigh Univeristy)

This work examines the behavior of a deep granular bed subject to simultaneous vertical vibration and stirring. The power necessary to stir a 5.6 cm diameter and 20 cm deep granular bed of 150 micron glass beads using a 4-blade vane impeller was measured over a wide range of forcing conditions. Impeller rotation rates from 0 - 1000 rpms and vibration accelerations in the range $0 \leq \Gamma = \omega^2 a/g \leq 4.0$ were explored. Both the power required for stirring and vibration were recorded. Sharp changes in vane power draw indicate flow transitions from dense granular flow to vibro-fluidized flow at a critical acceleration (Γ_c). The total power profile (vane plus vibration power) demonstrates a minimum just above the critical acceleration. Progressive increases or decreases n both vane speed and Γ independently show hysteresis as the flow bifurcates between two primary states of dense granular flow and loose-packed, vibrofluidized behavior. These observations are compared to those found in fluidized systems and flows generated in high-shear granulators. Finally, preliminary results of direct density measurements using a localized capacity probe will be discussed. These observations are compared to those found in fluidized systems and flows generated in high-shear granulators

APS Division of Fluid Dynamics
Salt Lake City, UT (Nov 18, 2007)
American Physical Society

Novel MEMS-Based Technology for Measuring the Mechanical Properties of a Live Biological Cell

Markus Gnerlich (Lehigh University), Wenyue Zhang (Lehigh University), Henry Donahue (Pennsylvania State University College of Medicine, Hershey), Arkady Voloshin (Lehigh University), Svetlana Tatic-Lucic (Lehigh University)

Keywords: cell mechanics, mechanical modulus, MEMS, electrothermal, polymer, dielectrophoresis

This paper presents an experimental platform for measuring the mechanical properties of live biological cells. The polymer-based MEMS device integrates a V-shaped electrothermal actuator (ETA) array, a force sensor, a displacement sensor, a thermal sensor, and a cell-positioning system in a single chip. The integrated cell-positioning system based on dielectrophoresis precisely places a cell to a designed spot, the MEMS ETA array provides a predefined deformation to the cell, the force and displacement sensors measure the magnitude of the force applied to the cell and the corresponding cell deformation, and the thermal sensor monitors temperature in the liquid cell medium environment during the experiment. This MEMS device was able to compress a NIH 3T3 fibroblast cell and cause 25% mechanical strain.

2008 SEM XI International Congress
Orlando, Florida USA (Jun 2, 2008)
Society for Experimental Mechanics

Effect of Pitch Rate on Time Evolution of Surface Topology on a Delta Wing

Tunc Goruney (Lehigh University), Donald Rockwell (Lehigh University)

A basic delta wing of moderate sweep angle, representative of Unmanned Combat Air Vehicles (UCAVs) and Micro Air Vehicles (MAVs), undergoes a pitching maneuver. Near-surface flow patterns are visualized by a technique of high-image-density particle image velocimetry for a wide range of pitch rates. Five different universal states are defined during the relaxation process following cessation of the pitching motion. These states involve distinct patterns that can be defined in terms of topological features such as negative (separation) and positive (reattachment) bifurcation lines, saddle points, foci, and nodes. Such universal states can be identified for all pitch rates, extending over an eightfold range. Irrespective of the severity of the flow distortion at the end of the pitching maneuver, the relaxation of the flow involves the same sequence of universal states. The time delay to occurrence of the first universal state is very sensitive to the pitch rate. The delay between subsequent states is, however, nearly independent of pitch rate. Due to the highly three-dimensional nature of the flow, the flow patterns and topological states will also be visualized by stereoscopic particle image velocimetry.

American Physical Society, 60th Annual Meeting of the Divison of Fluid Dynamics
Salt Lake City, UT (Nov 18, 2007)
American Physical Society

Deposition and meniscus alignment of DNA-CNT on a substrate

Constantine Khripin (Lehigh University), Ming Zheng (DuPont Inc), Anand Jagota (Lehigh University)

Keywords: carbon nanotubes meniscus alignment placement

We present a study of deposition and meniscus alignment of DNA-carbon nanotube (DNA-CNT) hybrids on a silicon wafer coated with an alkyl-silane monolayer. We show that this process occurs in two stages: adsorption of DNA-CNT onto the hydrophobic surface and subsequent alignment by a passing meniscus. In our work we study how the pH, ionic strength, and time affect the density of nanotubes deposited on the surface. We also study how surface density of nanotubes and the speed of the meniscus motion affect alignment of nanotubes. Experimental results are interpreted using models for the kinetics of deposition and for forces that affect alignment by the meniscus. We show that this deposition and alignment process can be used to generate spatially varying surface patterns that may be useful for applications that require targeted placement of nanotubes on a surface.

MRS2007 Fall Meeting
Boston, MA (Nov 29, 2007)
Materials Research Society

Rapid Convective Deposition Of Microsphere Monolayers For Fabrication Of Microlens Arrays

Pisist Kumnorkaew (Yik-Khoon Ee, Nelson Tansu, and James F. Gilchrist)

Micron-sized microspheres were deposited into thin films via rapid convective deposition using a similar method to that studied by Prevo and Velev, Langmuir, 2003. By varying deposition rate and contact angle, the optimal operating ranges in which 2D closed-pack of silica existed were obtained. Using a confocal laser scanning microscope, dynamic self-assembly of colloidal particles under capillary force during solvent evaporation was revealed. The resulting microstructure is controlled by varying the macroscale parameters and interaction between substrate and colloidal particles played an important role in formation of ordered crystalline arrays. Using the same technique, stacked layers of 1 micron silica monolayer on top of 1.1 micron polystyrene monolayers and subsequent melting of the polystyrene to partially wet the silica microspheres were deposited on GaN layer. This process was implemented on the top p-GaN layer of InGaN quantum wells light emitting diode (LEDs) device structure, resulting in the formation of a microlens array for enhancing its light extraction efficiency. This approach led to ~230% increase of the LEDs output power.

2007 AIChE Annual Meeting
Salt Lake City, UT (Nov 3, 2007)

Deposition of microsphere monolayers for microlens arrays

Pisist Kumnorkaew (Chemical Eng), Yik-Khoon Ee (Electrical Eng), Nelson Tansu (Electrical Eng), James F. Gilchrist (Chemical Eng)

Colloidal silica microspheres of 0.5 and 1 micron were deposited into thin films on a glass substrate via a rapid convective deposition method. By varying deposition rate and contact angle, the optimal operating ranges in which 2D closed-pack of silica existed were obtained. Using a confocal laser scanning microscope, dynamic self assembly of colloidal particles under capillary force during solvent evaporation was revealed. In addition, interaction between substrate and colloidal particles played an important role in formation of ordered crystalline arrays. The interaction was altered by varying pH (2-11) and salt concentration of either substrate rinsing solution or colloidal suspension. Using the same technique, stacked layers of 1 micron silica monolayer on top of 1.1 micron polystyrene monolayers and subsequent melting of the polystyrene to partially wet the silica microspheres were deposited on GaN layer. This process was implemented on the top p-GaN layer of InGaN quantum wells light emitting diode (LEDs) device structure, resulting in the formation of a microlens array for enhancing its light extraction efficiency. This approach led to ~230% increase of the LEDs output power.

81st ACS Colloid & Surface Science Symposium
U. of Dalaware (Jun 24, 2007)

Effect of mechanical strain on mobility of polycrystalline silicon thin-film transistors fabricated on stainless steel foil

Po-Chin Kuo (Lehigh University), Abbas Jamshidi-Roudbari (Lehigh University), Miltiadis Hatalis (Lehigh University)

Keywords: electron mobility, elemental semiconductors, hole mobility, semiconductor thin films, silicon, stainless steel, thin film transistors

The effect of uniaxial tensile strain parallel to the channel on mobility of polycrystalline silicon thin-film transistors on stainless steel foil has been investigated. The electron mobility increases by 20% while the hole mobility decreases by 6% as the strain increases to 0.5% and both followed by saturation as the strain increases further. The off current decreases for both types TFTs under strain. All TFTs remained functional at the applied strain of 1.13%.

International Symposium on Flexible Electronics and Displays
Hsinchu, Taiwan (Dec 17, 2007)

Mechanical Limitations of Materials for Steel Foil Based Flexible Electronics

Po-Chin Kuo (Lehigh University)

This work investigates mechanical limitations of thin film materials on steel foil substrates for flexible electronic applications. A three layer structure consisting of 100 µm thick stainless steel foil as the substrate, followed by 1 µm thick spin-on-glass passivation layer and 0.3 µm thick patterned aluminum interconnect layer on top with varying widths between 10-35 µm. A collapsing radius test method was adopted for the bending experiment and an elliptical curve fit was used to facilitate the strain measurement. The failure strain of aluminum interconnect layer was detected by monitoring the continuity of the test circuit during the experiment. The corresponding results reveal that the passivation layer cracked at a tensile strain of 0.46% and delaminated at a compressive strain of 0.68%. The metal interconnect layer ruptured at a tensile strain of 1.26% and delaminated from the substrate at a compressive strain of 1.22% due to the delamination of the passivation layer underneath. The steel foil substrate was plastically deformed at the relative small strain of 0.13%. The flexibility of steel foil based electronics can be effectively improved by using thinner foil substrates.

2007 MRS Fall Meeting
Boston, MA (Nov 26, 2007)

Transfer Learning of Hierarchical Task-Network Planning Methods in a Real-Time Strategy Game

Stephen Lee-Urban (Lehigh University), Austin Parker (University of Maryland, College Park, Maryland), Ugur Kuter (University of Maryland, College Park, Maryland), Hector Munoz-Avila (Lehigh University), Dana Nau (University of Maryland, College Park, Maryland)

We describe a new integrated and automated AI planning and learning architecture, called Learn2SHOP. Learn2SHOP departs significantly from the previous works on AI planning and learning in that its modular architecture integrates Hierarchical Task Network (HTN) planning, concept learning, and computer simulations. Using simulations during the planning

and learning process enables the system to get information about the outcomes of the actions. We have implemented Learn2SHOP and tested it on a transfer-learning task. The objective of transfer learning is transferring knowledge and skills learned from a wide variety of previous situations to the current, and likely different, previously unencountered problems(s). The experiments with Learn2SHOP have demonstrated the advantages of integrating planning, learning, and simulation in a real-time strategy game engine.

The International Conference on Automated Planning & Scheduling Workshop on Planning in Games (ICAPS-07)
Providence, Rhode Island, USA (Sep 22, 2007)
International Conference on Automated Planning & Scheduling (ICAPS)

RETALIATE: Learning Winning Policies in First-Person Shooter Games

Vasta, Megan (Lehigh University), Stephen Lee-Urban (Lehigh University), Munoz-Avila, Hector (Lehigh University)

In this paper we present RETALIATE, an online reinforcement learning algorithm for developing winning policies in team first-person shooter games. RETALIATE has three crucial characteristics: (1) individual BOT behavior is fixed although not known in advance, therefore individual BOTS work as "plug-ins", (2) RETALIATE models the problem of learning team tactics through a simple state formulation, (3) discount rates commonly used in Q-learning are not used. As a result of these characteristics, the application of the Q-learning algorithm results in the rapid exploration towards a winning policy against an opponent team. In our empirical evaluation we demonstrate that RETALIATE adapts well when the environment changes.

The Nineteenth Innovative Applications of Artificial Intelligence Conference (IAAI-07)
Vancouver, British Columbia, Canada (Jul 22, 2007)
Innovative Applications of Artificial Intelligence

Segmentation-Based Retrieval of Document Images from Diverse Collections

Michael A. Moll (Lehigh University), Henry S. Baird (Lehigh University)

Keywords: document content extraction, document content inventory, document content retrieval, versatility

We describe a methodology for retrieving document images from large extremely diverse collections. First we perform content extraction, that is the location and measurement of regions containing handwriting, machine-printed text, photographs, blank space, etc, in documents represented as bilevel, greylevel, or color images. Recent experiments have shown that even modest per-pixel content classification accuracies can support usefully high recall and precision rates (of, e.g., 80–90%) for retrieval queries within document collections seeking pages that contain a fraction of a certain type of content. When the distribution of content and error rates are uniform across the entire collection, it is possible to derive IR measures from classification measures and vice versa. Our largest experiments to date, consisting of 80 training images totaling over 416 million pixels, are presented to illustrate these conclusions. This data set is more representative than previous experiments, containing a more bal-

anced distribution of content types. Contained in this data set are also images of text obtained from handheld digital cameras and the success of existing methods (with no modification) in classifying these images with are discussed. Initial experiments in discriminating line art from the four classes mentioned above are also described. We also discuss methodological issues that affect both ground-truthing and evaluation measures.

Document Recognition & Retrieval XV
San Jose, CA (Jan 29, 2008)
SPIE/IS&T

Document Content Inventory and Retrieval

Michael A. Moll (Lehigh University), Henry S. Baird (Lehigh University)

Keywords: document image analysis, document layout understanding, document content extraction, document content inventory, tory, document content retrieval, document content frequency

We give an analysis of relationships between expected retrieval performance and classification recognition accuracy in the context of document image content extraction and inventory. By content extraction we mean location and measurement of regions containing handwriting, machine-printed text, photographs, blank space, etc, in documents represented as bilevel, grey-level, or color images. Recent experiments have shown that even modest per-pixel content classification accuracies can support usefully high recall and precision rates (of, e.g., 80–90%) for retrieval queries within document collections seeking pages that contain a given minimum fraction of a certain type of content. In an effort to elucidate this interesting empirical result, we have analyzed the interdependency of classification and retrieval under a variety of assumptions about the distribution of content types in document image collections. We show that under general conditions we cannot derive precision and recall measures from per-pixel classification measures alone, but we can estimate the expected values of these measures. If however the distribution of content and error rates are uniform across the entire collection, our results suggest, it is possible to predict precision and recall measures from classification accuracy and vice versa. historical documents; rectilinear and complex non-rectilinear layouts; and clean and degraded images.

9th International Conference on Document Analysis and Recognition (ICDAR07)
Curitiba, Brazil (Sep 23, 2007)
IAPR

Using Libs Measurements For Coal Quality Monitoring And Upgraded Power Plant Control

Ricardo X. Moreno (Lehigh University.), Carlos E. Romero (Lehigh University), Arel Weisberg (Energy Research Company.), Joseph Craparo (Energy Research Company), Robert De Saro (Energy Research Company), Larry Mulligan (Energy Research Company)

Laser-induced breakdown spectroscopy (LIBS) has been developed and applied to measure key inorganic components in coal ash – such as Si, Al, Fe, Na, Ca, Mg, and K – which contribute to the slagging and fouling behavior of pulverized coal. A coal inventory was assembled from fuels used at utility boilers with a range of slagging/fouling characteristics. These coals included

Eastern US bituminous and sub-bituminous coals and some foreign fuels. These coals were tested in a custom-built LIBS analyzer for ash metal composition and major element concentration (i.e. O, S, N). Detection limits are on the order of 0.01 percent, with variations depending on the particular element and type of coal. Measurement repeatability and accuracy are typically within ±10 percent (relative). The elemental analyses were used in concert with a neural network algorithm to calculate a slagging and fouling index for the prediction of deposition behavior. The values of the predicted indices are very similar to the resulting indices from standard coal analysis procedure. A future on-line version of the LIBS system will be installed at a 650 MW coal-fired unit and equipped with expert system-based software to demonstrate the real-time capabilities of this technology to monitor coal ash composition, slagging/fouling prediction and recommend actions to the operators for boiler operation modifications for slagging/fouling mitigation.

Environmental Monitoring, Evaluation, and Protection in New York: Linking Science and Policy
Albany, NY (Nov 15, 2007)
New York State Energy Research and Development Authority (NYSERDA)

Mars Rover in Middle School

Isaac Rieksts (Lehigh University), Glenn Blank (Lehigh University)

We have developed an innovative curriculum using one sixth replicas of the rovers currently on Mars. Each student receives hands-on experience by performing missions in a simulation program. These missions allow students to relate to the process of controlling the actual rovers. Furthermore, students have an opportunity to remotely program and control the replicas in a realistic Martian landscape created in the basement of a middle school. Programming robots in this landscape is the centerpiece of a technology curriculum in all four middle schools in the Allentown School District as well as a summer and Saturday program at Lehigh University.

Society for Information Technology and Teacher Education (SITE)
Las Vegas, Nevada, USA (Mar 3, 2008)

Game AI for a Turn-based Strategy Game with Plan Adaptation and Ontology-based Retrieval

Antonio Sánchez Ruiz (Universidad Complutense de Madrid, Madrid, Spain), Stephen Lee-Urban (Lehigh University), Héctor Muñoz Ávila (Lehigh University), Belén Díaz Agudo (Universidad Complutense de Madrid, Madrid, Spain), Pedro González Calero (Universidad Complutense de Madrid, Madrid, Spain)

In this paper we present a novel approach for developing adaptive game AI by combining case based planning techniques and ontological knowledge from the game environment. The proposed architecture combines several components: a case-based hierarchical planner (Repair-SHOP), a bridge to connect and reason with Ontologies formalized in Description Logics (DLs) based languages (OntoBridge), a DLs reasoner (Pellet) and a framework to develop Case-Based Reasoning (CBR) systems (jCOLIBRI). In our ongoing work we are applying this approach to a commercial Civilization clone turn-based strategy game (CTP2) where game AI is in charge of planning the strategies for automated players. Our goal is to

demonstrate that ontology-based retrieval will result in the retrieval of strategies that are easier to adapt than those plans returned by other classical retrieval mechanisms traditionally used in case-based planning.

The Seventeenth International Conference on Automated Planning & Scheduling Workshop on Planning in Games (ICAPS-07)
Providence, Rhode Island, USA (Sep 22, 2007)
International Conference on Automated Planning & Scheduling (ICAPS)

Risk-averse Policies in a One-Warehouse Multiple-Retailer System with Demand and Supply Uncertainty

Amanda J. Schmitt (Lehigh University), Lawrence V. Snyder (Lehigh University), Zuo-Jun Max Shen (University of California, Berkeley)

We examine demand and supply uncertainty in a One-Warehouse Multiple-Retailer system and compare centralized and decentralized inventory strategies. We show that while risk pooling generates lower expected costs in a centralized strategy, risk diversification generates lower risk in a decentralized strategy. We demonstrate that under certain risk-averse objectives, decentralizing inventory is the optimal policy for the OWMR system.

INFORMS Annual Meeting
Seattle, WA (Nov 5, 2007)
Institute For Operations Research and the Management Sciences
Keywords: Broadband gain, quantum-dot laser, linewidth enhancement factor

Simulation of Derivative Characteristics of Broadband Quantum Dot Lasers

Chee-Loon Tan (Lehigh University), Yang Wang (Lehigh University), Her Susanto Djie (Lehigh University), Boon-Siew Ooi (Lehigh University)

We present the development of theoretical model based on multi-population rate equation to assess the derivative optical gain and chirp characteristics from the multiple states broadband InGaAs/GaAs quantum-dots laser. Our results show that the linewidth enhancement factor from the ground state is slightly larger but in the same order of magnitude as the values obtained in conventional quantum-dot lasers. This study is important in proving the competency of this novel device for diverse applications.

IEEE NUSOD'07 (Numerical Simulation of Optoelectronic Devices)
University of Delaware, Delaware. (Sep 24, 2007)
IEEE (Institute of Electrical and Electronic Engineers)

Model Predictive Control of Cyclic Systems Using Linear Matrix Inequalities

Pradeep Tiwari (Lehigh University), Mayuresh V. Kothare (Lehigh University)

Keywords: Repetitive and cyclic systems, 2D cotnrol, MPC, LMI

Cyclic processes can be characterized by two time variables, viz, the time within a cycle and the cycle index, each carrying a distinct connotation of time. Conventional optimal control theory does not explicitly account for these two

dimensions (2D) of time that characterize cyclic systems. In this paper, we study the control of cyclic process using Model Predictive Control (MPC). The proposed approach uses a 2D Lyapunov function and the stability requirements are established along each time dimension of the system. The resulting controller synthesis problem is expressed in convex form using Linear Matrix Inequalities (LMIs). The approach allows incorporation of input/output constraints in the proposed 2D MPC framework. An example of a cyclic process is presented to establish the applicability of the proposed approach.

AIChE Annual Meeting
Salt Lake City, UTAH (Nov 5, 2007)

Multivariable Anti-Windup Controller Synthesis incorporating Multiple Convex Constraints

Pradeep Tiwari (Lehigh University), Eric F. Mulder (ExxonMobil), Mayuresh V Kothare (Lehigh University)

Keywords: Constrained systems, Anti-windup control, optimal control, LMI

We study the problem of multivariable anti-windup controller synthesis that incorporates trade-offs between unconstrained linear performance and constrained anti-windup performance. In our previous work [13] we presented a framework for simultaneous design of a linear output feedback controller and a static anti-windup compensator using Linear Matrix Inequalities (LMIs). This framework deviated from the conventional two step paradigm of anti-windup by proposing a one-step synthesis while still maintaining the anti-windup structure. However, the work in [13] did not provide conclusive demonstration of the efficacy of this formulation through realistic practical examples. In this paper, we further study the framework in our previous work and explicitly demonstrate its capability in providing effective constrained anti-windup controller performance for two benchmark problems, viz. a vibration isolation table and a multivariable model for the longitudinal dynamics of an F8 aircraft.

American Control Conference
Newyork, NY (Jul 13, 2007)

Adaptation of Hierarchical Task Network Plans

Ian Warfield (Lehigh University), Chad Hogg (Lehigh University), Stephen Lee-Urban (Lehigh University), Héctor Muñoz-Avila (Lehigh University)

This paper presents RepairSHOP, a system capable of performing plan adaptation and plan repair. RepairSHOP is built on top of the HTN planner SHOP. RepairSHOP has three properties. The first property is its design modularity, which makes it is straightforward to apply the same process discussed in this paper to build plan adaptation capabilities in other HTN planners. Second, RepairSHOP can perform plan repair. Third, RepairSHOP takes into account failed traces during plan adaptation/repair. As a result, it can result in improvements in running time performance. We performed experiments demonstrating performance gains of plan adaptation over plan generation from the scratch, measured in CPU time for problem solving.

The Twentieth FLAIRS International Conference (FLAIRS-07).
Key West, Florida (May 7, 2007)

SHIM: A Scalable Hierarchical Inter-domain Multicast Approach for Disruption Tolerant Networks

Qing Ye (Lehigh University), Liang Cheng (Lehigh University), Mooi Choo Chuah (Mooi Choi Chuah), Brian D. Davison (Mooi Choi Chuah)

Disruption Tolerant Network (DTN) technologies are emerging solutions to networks that experience frequent partitions. In this paper, we propose the scalable hierarchical inter-domain multicast (SHIM) approach for DTNs. SHIM has the following characteristics: i) it is capable of delivering multicast messages to receivers distributed in different domains; ii) the size of the membership information maintained by the source leader is determined by its out-degree in the leader layer, no matter how large the number of the real receivers is; and iii) it at least doubles the message delivery efficiency than that of directly extending the existing intra-domain DTN multicast methods to perform the inter-domain multicast operations. Our results also show that the message delivery ratio of SHIM can be improved to be almost 100% when the custodian transfer functionality is enabled in the overall networks.

IWCMC 2007
Hawaii (Aug 11, 2007)
ACM

Polymer MEMS System For Measuring The Mechanical Modulus Of A Biological Cell

Wenyue Zhang (Lehigh University), Markus Gnerlich (Lehigh University), Yaohua Sun (Lehigh University), Gaoshan Jing (Lehigh University), Jonathan J. Paly (Lehigh University), Arkady Voloshin (Lehigh University), Svetlana Tatic-Lucic (Lehigh University)

Keywords: Cell mechanics, mechanical modulus, MEMS, polymer, dielectrophoresis

The measurements of the mechanical modulus of biological cells are critical to studies of pathophysiology and the research for an effective treatment. This research has developed a rapid and cost effective technique in order to measure the Poisson's ratio and mechanical modulus of a live biological cell by utilizing microelectromechanical system (MEMS) techniques in a biological application. The design, fabrication, and characterization of a polymer-based MEMS system that integrates a V-shaped electrothermal actuator array and a cell-positioning system in a single microelectronics chip are presented here. This BioMEMS device compressed a NIH 3T3 fibroblasts cell and caused up to 25% mechanical strain.

BioDevices 2008
Funchal, Madeira, Portugal (Jan 28, 2008)
Biostec

Temperature Dependant Characteristics of Scaled NMOS Transistors with Ultra-thin High-K Dielectrics and Metal Gate Electrodes

Yanli Zhang (Lehigh University), Luckshitha S. Liyanage (Lehigh University), Gan Wang (Lehigh University), Zhian Jin (Lehigh University), Marvin H. White (Lehigh University)

Keywords: High-K, Metal Gate, High Temperature, Threshold Voltage, Mobility, Gate Leakage

In order to maintain the continuous scaling of CMOS devices, high-K dielectrics and metal gate electrodes have been used at ITRS (International Technology Roadmap for Semiconductor) 45nm technology node. In this paper, we discuss the temperature dependence of the threshold voltage, electron mobility and gate leakage current for the scaled NMOS transistor, which has an interfacial SiO_2 layer (0.5nm) and an ALD (Atomic Layer Deposition) fabricated HfO_2 dielectric layer (2.0nm) with a 10nm TiN metal gate electrode covered by polysilicon. Our analysis indicates both the threshold voltage and the electron mobility decrease with increasing the temperature, and the metal workfunction decreases at a rate of ~ 10-4 eV/K. Gate leakage current increases with the temperature, which will increase power consumption at high temperature.

International Semiconductor Device Research Symposium
College Park, MD (Dec 12, 2007)
IEEE Electron Device Society

A Quantum Mechanical Model of Gate Leakage Current for Scaled NMOS Transistors with Ultra-thin High-K Dielectrics and Metal Gate Electrodes

Yanli Zhang (Lehigh University), Zhian Jin (Lehigh University), Gan Wang (Lehigh University), Luckshitha S. Liyanage (Lehigh University), Marvin H. White (Lehigh University)

The continuous scaling of the gate insulator layer thickness in CMOS devices leads to excessive gate leakage current and device reliability problems. High-K material has been used to achieve equivalent electrical thickness with thicker physical thickness to reduce the gate leakage and improve the device performance at ITRS (International Technology Roadmap for Semiconductor) 45nm technology node. In this paper, we have investigated the gate leakage current by considering both direct tunneling (DT) and trap-assisted tunneling (TAT) quantum mechanically for a scaled NMOS transistor, which has an interfacial SiO_2 layer (0.5nm) and an ALD (Atomic Layer Deposition) fabricated HfO_2 dielectric layer (1.6nm) with a 10nm TiN metal gate electrode covered by polysilicon. In our simulations, we conclude 80% of the current is carried by DT and 20% of the current is carried by TAT. Gate leakage current varies with dielectric layer thickness, and DT current is more sensitive to the physical thickness compared with TAT current. The proper control of the interfacial layer is important to continue CMOS device scaling.

International Semiconductor Device Research Symposium
College Park, MD (Dec 12, 2007)
IEEE Electron Device Society

A Quantum Mechanical Mobility Model for Scaled NMOS Transistors with Ultra-thin High-K Dielectrics and Metal Gate Electrodes

Yanli Zhang (Lehigh University), Zhian Jin (Lehigh University), Gan Wang (Lehigh University), Luckshitha S. Liyanage (Lehigh University), Marvin H. White (Lehigh University)

Keywords: Quantum Mechanical, High-K, Metal Gate, Mobility, Coulomb Scattering, Surface Roughness

At the ITRS 45nm technology node, NMOS transistors with high-K dielectrics have an effective oxide thickness (EOT) less than 1nm. Electron mobility in these devices is affected by quantization of carrier energy and a redistribution of carriers at the semiconductor and gate dielectric interface due to the decrease of the gate dielectric layer thickness and the increase of substrate doping. Electron mobility is also affected by surface roughness and Coulomb scattering rising from the interface traps and fixed charges in the high-K layer. We develop a quantum mechanical model for electron mobility, including Coulomb scattering of carriers and surface roughness in scaled high-K, metal-gate, NMOS transistors, which predicts an increase in Coulomb scattering mobility and a slow decrease of surface roughness mobility with increasing the gate voltage. The total mobility is limited by the bulk mobility because of the need for highly-doped substrates for scaled 45nm node transistors.

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Dear Reader,

On behalf of the Graduate Student Senate, it is my honor to thank our sponsors, without whom the ***Graduate Research Review*** would not have been possible.

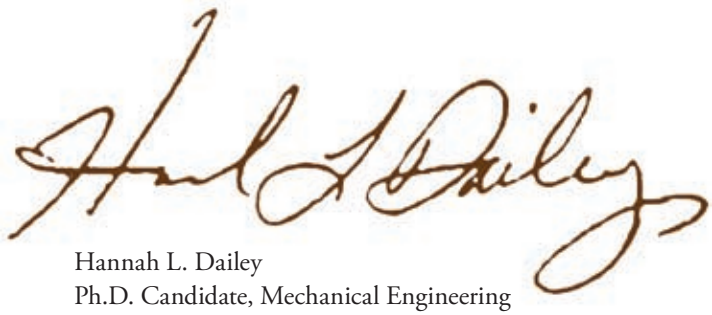
First and foremost, we are grateful for the generous financial support of our corporate sponsor, Becton, Dickinson and Company. In particular, we thank BD representative Joel Krayer (Lehigh '03, '05G), whose energy and enthusiasm were invaluable assets to the project.

We are also delighted to recognize the creative inspiration and financial support of the Lehigh University chapter of Sigma Xi, the scientific research society. Special thanks goes to chapter President, Dr. John Nyby, who promoted our efforts and upheld Sigma Xi's commitment to honoring scientific accomplishments, encouraging original investigation, and fostering interaction among researchers.

Of course, this First Edition would have remained a dream without the encouragement and tireless support of Lehigh's Graduate Life Office Director, Dr. Kathleen Hutnik, and Vice Provost for Student Affairs, Dr. John Smeaton. Their vision for graduate education at Lehigh is an inspiration to all of us.

Finally, thank you to all of our contributing authors, both the graduate students and the faculty advisors and mentors. The ***Graduate Research Review*** represents the fruit of your labors and we are proud to be part of this community of scholars. You make Lehigh at wonderful place to live, learn, and grow.

Sincerely,



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