

The Fifth Annual

Undergraduate
Research

&

Creative
Achievement
Day

2001

UMBC
A N H O N O R S
U N I V E R S I T Y
I N M A R Y L A N D

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SCHEDULE OF EVENTS

9:00 a.m. – 1:00 p.m. Concurrent Sessions

Oral Presentations, Room 767, Albin O. Kuhn Library & Gallery
Poster Sessions, 7th Floor, Albin O. Kuhn Library & Gallery
Musical Performances, Room 767, Albin O. Kuhn Library & Gallery
Visual Arts Exhibits, 7th Floor, Albin O. Kuhn Library & Gallery

1:00 p.m. – 2:00 p.m. Formal Program, Room 767

Remarks by:
President Freeman A. Hrabowski, III
Provost Arthur T. Johnson

Faculty Speakers

Topic: The Importance of Undergraduate Research and Creative Achievement

- Dr. Lisa Kelly
Assistant Professor, Chemistry and Biochemistry
- Dr. Edward Orser
Professor, American Studies

Introduction of the 2001-2002 Undergraduate Research Award Recipients

- Diane M. Lee
Vice Provost for Student Academic Affairs

2:00 p.m.

Reception

7th Floor, Albin O. Kuhn Library & Gallery

Poster and artistic exhibits will remain available for viewing until 4 p.m.

April 25, 2001

Dear Participants and Visitors:

I am pleased to welcome you to UMBC's fifth annual Undergraduate Research and Creative Achievement Day. This event has been established as an annual recognition of the outstanding work of our undergraduates in all academic areas - the arts, the sciences, the humanities, the social sciences and engineering. More than 300 students, most of whom are now alumni, have presented, exhibited or performed in past celebrations, and many recall our campus event as a first opportunity to share their research and created works.

UMBC supports undergraduate research in a number of ways, and this year's commitment has been particularly strong. This marks the first year that Undergraduate Research Award Scholars received, in addition to stipends for their research, full support to present at the National Conference for Undergraduate Research at the University of Kentucky. A total of 24 UMBC students participated in this prestigious gathering of approximately 2,500 students from more than 400 colleges. We also have published the second edition of UMBC Review, our journal dedicated to the research and creative work of our undergraduate students. Please enjoy a copy of this newly published edition, available today at the journal's display table.

This year's Undergraduate Research and Creative Achievement Day is but one of many events that attest to UMBC's salute to research of all of our students, throughout every discipline. Beginning with last Wednesday's Graduate Research Day, co-hosted with the University of Maryland, Baltimore, we have seen students at every stage of academic study engaged in scholastic presentations. We hope that you will enjoy other campus events throughout this day, events that include the Humanities Forum, the Visiting Artist Lecture Series, the Department of Theatre's Main Stage Production of Macbeth and a tribute to student research by guest lecturer Homer Hickam.

Thank you for being here today. Please discuss with our undergraduates their projects and broader research goals. We take great pride in their accomplishments and their aspirations.

Sincerely,
Arthur T. Johnson
Provost

PRESENTERS

Presenters are listed in alphabetical order by type of presentation. Some students are involved in joint projects as described in the abstract section. The number refers to the page on which the abstract is found.

** 2000-2001 Undergraduate Research Award Winner*

t Participant in the 2001 National Conference on Undergraduate Research (NCUR)

Oral Presentations

Baker, Jason *t	Philosophy
Belt, Kriste	Music
Fisch, Kim*	Dance
Hutchison, Jill *	Interdisciplinary Studies (INDS)
Kashim, Jeehan	Psychology
Kolejian, Dzovig	Biochemistry and Molecular Biology
Lee, Susan *t	American Studies and English
McDougall, Harold	Political Science
Ndassa, Yasmine *t	Structural and Molecular Biology
Ritter, Bethann	American Studies and Political Science
Skolnik, Jessica	American Studies
Smith, Robert *	Mechanical Engineering
Stokes, Sutton	American Studies and Education

Poster Presentations

Afshari, Hessam	Chemical Engineering
Booth, Ada	INDS/Biopsychology
Couvillon, Heather	Chemical Engineering
Dehn, Melissa *	Sociology
Desai, Shital	Biochemistry and Molecular Biology
Dharia, Sweta	Psychology
Gilbert, Mileka t	Biological Sciences
Kumbalasiri, Tida t	Biological Sciences and Psychology
Locatelli, Kristen	Economics and Political Science
McGee, Sasha *t	Chemistry
Maduike, Nkabuije t	Biochemistry
Mathews, Marlene *t	Biological Sciences
Radtka, John *t	Biological Sciences
Robucci, Ryan *t	Computer Engineering
Rossell, Cynthia	Psychology
Skinner, Jason *	Microbial Genetics
Staroswiecki, Ernesto *t	Computer Engineering
Stewart, Raj t	Biological Sciences
Walker, Andre *	Molecular Biology /Physiology
Williams, Calvin *t	Chemistry
Zeiger, Diana *t	Chemistry

Artistic Presentations

Knauer, Nathan	Music
Lasher, Theresa	Music
Lazzaro, Gregory	Music
Baldwin, Kassie	Music
Barad, Benjamin	Music
Bord, Lyudmila	Music
Denisyuk, Albina	Music
Makhnichenko, Yelena	Music
Martinez, Karla	Music
Niemeyer, Kim	Music
Pinkley, Ronald	Music
Remeslennik, Vitali	Music
Strekalov, Denis	Music
Swartwout, Arthur	Music
Vesnovsky, Yana	Music
Wixom, Ryan	Music

Artistic Exhibits

Ayres, Chase	New Genre
Barocca, Chrimson	IMDA Class Interactive Project
Brown, Timothy	IMDA Class Interactive Project
Choi, In	IMDA Class Interactive Project
Clougherty, Christen	New Genre
Craun, Ryan	IMDA Class Interactive Project
Eisenberg, Aaron	INDS/Judaic Studies and Photography
Filburn, Sean	IMDA Class Interactive Project
Flanders, Rebecca	IMDA Class Interactive Project
Gates, Jenae	IMDA Class Interactive Project
Goode, Adam	IMDA Class Interactive Project
Hanlon, Bridget	IMDA Class Interactive Project
Jones, Jason	IMDA Class Interactive Project
Kesler, Kelissa	IMDA Undergraduate Web Gallery
Lubawski, Jason	IMDA Undergraduate Web Gallery
McCauly, Trevor	IMDA Class Interactive Project
McGinness, Chris	IMDA Class Interactive Project
Marksamer, Justin	IMDA Class Interactive Project
Moellers, Dennis *	Imaging and Digital Arts (IMDA)
Perrie, Steve	IMDA Class Interactive Project
Rojas, David	IMDA Undergraduate Web Gallery
Sakellion, Joanna	IMDA Undergraduate Web Gallery
Schulke, Hilda	IMDA Class Interactive Project
Thatch, My-Lin	IMDA Class Interactive Project
Thompson, Daren	IMDA Class Interactive Project and IMDA Undergraduate Web Gallery
Tirdil, Allison	IMDA Undergraduate Web Gallery

**2001 PROVOST'S UNDERGRADUATE RESEARCH
AND CREATIVE ACHIEVEMENT DAY COMMITTEE**

Diane M. Lee, Chair Vice Provost for Student Academic Affairs Associate Professor, Education	Beth Pennington Assistant to the Provost Academic Affairs
Steve Bradley Associate Professor Visual Arts	Kathy Sutphin Coordinator of Special Projects Biological Sciences
Nessly C. Craig Associate Professor Biological Sciences	Tim Topoleski Professor Mechanical Engineering
Stephen M. Miller Assistant Professor Biological Sciences	Zoe Warwick Associate Professor Psychology
Joseph C. Morin Assistant Professor Music	Victor Wexler Associate Dean of Arts and Sciences Associate Professor, History

ACKNOWLEDGEMENTS

The organizing committee would like to express its gratitude to the many people who helped make this day possible. First and foremost, we thank the student participants and faculty advisors whose talent and dedication inspire the entire event. Provost Art Johnson, whose support continues to make this event and other initiatives an annual testimony to UMBC's commitment to undergraduate research, deserves special appreciation. Provost's Office staff members Linda Hatmaker, Sue McMillian, Susan Mocko and Kathy Miller have provided essential administrative support to this event, as have student assistants Kim Wilhelm and Yekaterina Trubitsyna.

Each year we are indebted to the faculty advisors, whose support of the participating students is essential and yet often unsung. The tremendous effort made by members of the Undergraduate Research Awards Committee to screen applications and identify many of the talented students featured in each year's event should be acknowledged. We thank the members of last year's Undergraduate Research Awards committee, whose reviews have contributed to selecting today's participants: Mauricio Bustos, Robert Deluty, Raphael Falco, Doug Hamby, Ramachandra Hosmane, Vin Grabill, Marjoleine Kars, Katherine Keller, Willie Lamouse-Smith, Claudia Lawrence-Webb, Gust Mitchell, Wendy Salkind, Gavin Watson and Ken Young.

We are honored that Lisa Kelly, assistant professor in the Department of Chemistry and Biochemistry, and Edward Orser, professor in the Department of American Studies, will speak on the importance of undergraduate research. Their personal mentorship of many of the students who have participated in this event has been noteworthy. For their assistance in moderating the oral presentations, we thank professors Panos Charalambides, Linda Dusman, Geoffrey Vaughan and Carol Hess.

Our gratitude is always owed to Larry Wilt, Linda Durkos, Tom Beck, Cynthia Wayne and Sylvia Wright for their annual efforts to facilitate our use of the Albin O. Kuhn Library. Among the many individuals who have assisted in the publicity and planning for this event are Lisa Akchin, Jack Suess, John Fritz, Sandra Dzija, Karen Baxter, Michelle Healy, Charlie Melichar, Sandy Campbell, Tom Taylor, Yvette Mozie-Ross, Dale Bittinger, Jose Barata, Erin Senack and Jennifer Dress. Special appreciation goes to Sara Sommerville, Joe Ferraro and Lidia Ferrara for the design and production of this program, invitations and various displays. The Retriever Weekly staff has also supported our publicity efforts, and we appreciate the announcements of radio station WMBC.

Oscar Berninger and the staff of Wood Food Service have worked to provide an enjoyable reception, and Brian Shipley and the Student Workforce staff provide unseen but invaluable support to this event. The help of Audio-Visual Services will be especially evident this year, and we thank Steve Anderson and his staff for their assistance.

Members of the President's staff Doug Pear, Karen Wensch, Kathy Raab and Sue Bosley "sooner or later" always provide assistance for this event and have facilitated the participation of President Freeman Hrabowski, whose spirited leadership continually inspires celebration of student achievement. A heartfelt word of appreciation goes to the family and friends who, with loyal pride and ceaseless support, come to hear their special presenter each and every year. Your encouragement is often unacknowledged, though not unnoticed or unappreciated.

Lengthy though our list, we never can include the entire cast of individuals who help with this event. To all who have assisted in any way (even as the day progresses), we are most grateful.

ORAL PRESENTATIONS

Philosophy

Can the Species Category Serve Two Masters? The Role of Evolutionary Theory in Taxonomy

Jason M. Baker

Advisor: Professor Jessica Pfeifer

Abstract:

Defining biological species has remained problematic since Charles Darwin (1964) dispelled the notion that species are natural kinds, or fixed, essential forms (Plato's eide). With the conceptual revolution Darwin brought to natural history came the need to reevaluate species as evolving lineages. Ambiguities concerning the precise nature of species taxa within evolutionary theory, however, have created persistent difficulties for fitting systematics within the framework of evolutionary biology. As a result, taxonomic pluralism has become "the party line" among philosophers of biology today (Hull 1999). Yet this need not be. The answer, I argue, is the General Lineage Concept, recently proposed by Kevin de Queiroz (1998). On his account, the species category can accommodate the hitherto conflicting interests of systematists and evolutionary biologists. Specifically, the General Lineage Concept allows (i) systematists to classify species as basal taxonomic units and (ii) evolutionary biologists to treat species as the units of evolutionary analysis.

References:

1. Darwin, C. 1964. *On the Origin of Species: A Facsimile of the First Edition*. Cambridge, Mass.: Harvard University Press. Originally published by John Murray (London, 1859).
2. de Queiroz, K. 1998. The general lineage concept of species, species criteria and the process of speciation: a conceptual unification and terminological recommendations. In *Endless Forms: Species and Speciation*, eds. D. J. Howard and S. H. Berlocker, 57-75. New York: Oxford University Press.
3. Hull, D. L. 1999. On the plurality of species: questioning the party line. In *Species: New Interdisciplinary Essays*, ed. R. A. Wilson, 23-48. Cambridge, Mass.: MIT Press.

Music

The Misunderstood Woman and the Scrutiny She Faces as Seen in the Life of Susannah Polk

Kriste Belt

Advisor: Professor Aya Ueda

The way in which women interact with society and vice versa is intriguing yet complicated. When seen in the venue of theatre, this relationship can be examined closely at various levels. For centuries, women's roles in society often have been misunderstood and unappreciated. In this presentation, I will analyze the character of Susannah Polk in Carlisle Floyd's opera *Susannah* (1955) and the way in which she, as a woman, is regarded in her social setting. The opera is based on the book of *Susannah* found in the

apocrypha, but the setting is moved to the Appalachian Mountains-New Hope Valley, Tennessee during the 1950s. This town is secluded from the rest of the world, and the stereotypical people of the town suffer from a rather provincial mindset. The driving drama of the story is that the three male elders find Susannah "exposing herself" bathing naked in a creek. Susannah is an 18-year-old, beautiful young woman who is also put in a vulnerable position because of her upbringing. The lust the men feel toward Susannah drives them to accuse her of being sinful and devilish, thus making her an outcast. The townspeople, together with a traveling evangelist, Reverend Blitch, urge her to confess her sins publicly and repent. Blitch cares about her soul, yet he is also lustfully attracted to her body. In the end, Blitch takes advantage of her vulnerability and loneliness and robs her of her virginity.

In this opera, Susannah is not a typical ingenue, but is portrayed as a realistic woman with her own aspirations, struggles and strengths. A comparison will be made between her character and the character of Pamina in Mozart's Magic Flute. Pamina is stereotyped in a role of a submissive woman, who allows others to control her. Through my study of Susannah's character, I have found many interesting issues concerning women and how they are seen in the eyes of society. I will explore these two operas in terms of how the female characters are used to voice the sociopolitical opinions of the time. Heroines of operas are often beautiful. However, a woman's beauty and sexuality often threaten society's acceptable morality. The main questions that arise are: 1) what defines a virtuous woman in a particular society? and 2) where does that society draw the line for her in terms of the expression of her sexuality? Beautiful women are often misconceived as being loose. Their sexuality attracts men, yet at the same time, intimidates them. Thus, the men feel the need to control them and try to reassume power so that they can be viewed as the stronger of the two sexes. This is done in numerous ways; however, the woman is always made to feel helpless and inferior.

My study also will refer to ideas discussed in Lucy Green's Music, Gender, Education and articles concerning feminism and opera. In addition, I will analyze how the music itself expresses the depth of Susannah's character. It is my desire to uncover the true essence of the characters I portray; I feel that it is important for the performers and for their art. As part of the presentation, I also will sing the aria "The Trees on the Mountain" from the opera. My main goal is to give a fleshed-out representation of Susannah to understand her emotional journey fully. I believe that this fervor about the arts is needed for artists to create an intelligent, awe-inspiring approach to their craft, their art.

Dance

Laban Movement Studies: An Introduction

Kim Fisch

Advisor: Professor Doug Hamby

"Observing the movement of oneself or others is a touchstone to knowledge."

Peggy Hackney, from her studies with Irmgard Bartenieff.

"... To pay more attention to human movement-bodily and mentally-which is obviously at the basis of all human activity."

Rudolf Laban

Understanding the core concepts of Laban Movement Studies introduces enormous possibilities for

dance and movement exploration. With the Provost Research Award, I was able to study Laban Movement Studies at the Laban Centre in London, where I was introduced to Rudolf Laban's work and theory through physical exercises and analytical discourses. Rudolf Laban (1879-1958) was a dancer-choreographer who was interested in exploring movement possibilities within and beyond the dance world. Laban understood human movement to be a fundamental part of our existence, contributing to how human beings relate to themselves, to one another and to the surrounding environment. He created an enormous body of work that has been tremendously influential on the dance world, initiating the fields of dance research, analysis, criticism and appreciation. Laban's work serves as a framework for developing choreography, observing, interpreting, analyzing, exploring and appreciating movement. His work provides a fundamental structure for areas such as dance education, dance therapy and personality assessment through psychological analysis. Laban's theories are an excellent tool for learning movement quickly, efficiently and deeply-allowing dance students to think critically, develop greater body awareness, deconstruct movement in terms of its origins and experience integrated connections. Laban's work opens up more possibilities for teaching, learning, sharing and understanding movement-to maintain explorational authenticity, discover an active inner space and outer body, to locate the origin of movement, comprehend natural impulses and reactions, and have meaningful experiences.

The five fundamentals (core concepts) for Laban's work, which can be explored separately, as well as through complex interrelations with each other:

1. Body- vessel with natural affinities and limitations of movement. The body is the material of the dance. (Examples include: hands, knees, feet, torso, spine, the whole body, etc.)
2. Space- where the dance is located and where the body is going. Space is the defined context of the dance, whether it is a stage or abstract environment, the inside and the outside of the body, the general environment or personal space of the dancers.
3. Relationships- physical, emotional, metaphysical, virtual and spatial connections between the dancers and the surrounding environment. Relationships refer to 'with whom' or 'with what' the actions occur.
4. Action- what the body is doing. Actions take place within the body or within relationships. (Examples include: bend, stretch, twist, turn.)
5. Dynamics- how the body is used, the effort quality and the qualitative aspect; includes body flow, weight and duration of movements.

Time is not one of Laban's fundamentals, but is intrinsically involved with dance. Time refers to decision-making and change.

Laban studies have greatly increased my hunger for exploring movement. I am choreographing a dance performance work, integrating Laban's methods with my own. In this work, which is my final project for the interdisciplinary studies major, I use dance as the language to express the contradictions that exist in the connections between dance, performance and gender. Although I will be showing a video of the dance during the presentation, the full dance work will be performed at 8 p.m. Friday, April 27 and Saturday, April 28 in Fine Arts 317. The admission to the performance is free.

Interdisciplinary Studies
Chesapeake: The Living Waters
An Interactive Tutorial for Middle School Environmental Science

Jill L. Hutchison

Advisor: Professor Vin Grabill

The purpose of this project is to create an interactive tutorial for the World Wide Web and computer CD-ROM for use by Maryland middle school students (ages 11-13) to learn about Submerged Aquatic Vegetation (SAV) in the Chesapeake Bay.

This project is designed in keeping with the educational philosophy and practice of constructivism. This way of teaching involves active, hands-on, minds-on exploration by students who plan and guide their own learning process; the use of literature in the classroom; and cross-curricular integration around themed units. These units center around topics that are authentic-of real and direct importance to the students' lives and communities-and which cross over the boundaries of traditional curriculum divisions of science, social science and language arts. This project is in response to the pressing need for excellent educational materials that support the constructivist model and move beyond textbooks and worksheets to engage children's minds and senses in exploring, experimenting, observing, researching, writing and acting creatively to improve their world.

SAV is an ideal topic for constructivist educational materials. The topic is authentic and locally important and tied into other issues about which the students and the community care-the conservation and restoration of the Chesapeake Bay. SAV has declined dramatically in the bay in the last century, from a historical coverage of up to 300,000 acres, or 11 percent of the total surface area of the Chesapeake system, to just 50,000 acres today. SAV serves many critical functions for the health of the bay ecosystem, and its current decline is associated with widespread degradation in water quality, in productivity and in the abundance and health of almost every species of living thing in the Chesapeake.

In studying this vital but often-overlooked part of the bay ecosystem, students will explore important concepts in biology, chemistry, ecology, geography and geology, social science and civics. Module topics within the tutorial include an overview of the Chesapeake Bay as an estuary, watersheds, tides, salinity, erosion, sedimentation, turbidity, point-source and non-pointsource pollution, habitats, food webs, primary productivity, vascular plant biology, photosynthesis, respiration, the Coriolis effect and "Critical Area" legislation. The tutorial will cover these topics using hypertext with internal and external links; full-motion video, animation and graphics elements such as maps, photographs and drawings; audio; and interactive games and quizzes.

Production of the tutorial modules is in progress; it is anticipated that the project will be completed and ready for launch on the World Wide Web and/or publication on CD-ROM by the presentation date. When complete, this interactive multimedia tutorial will be distributed for use by students and educators as an example of the powerful new type of educational materials possible in the digital age.

Psychology

The Role of Informal and Formal Social Support in Maternal Adjustment to Pediatric Cancer

Jeehan H. Kashim

Advisor: Professor Lynnda Dahlquist

The purpose of this study is to examine the effect of perceived social support on adjustment among mothers of pediatric cancer patients. Previous research has suggested that increased levels of perceived social support lead to better adjustment among individuals in several contexts, including parents of chronically ill children (Morrow, Carpenter & Hoagland, 1984; Speechley and Noh 1992). In addition to the effects of social support as a whole, individual sources of support also may have different effects on a person's level of adjustment to a major life event (House, 1981). These sources can be categorized into two groups, informal support (e.g., spouse, friends, relatives) and formal support (e.g., social workers, psychologists, physicians).

Defining "better adjustment" among mothers of pediatric cancer patients in terms of low depression, low anxiety, as well as low marital conflict, in this study, it was hypothesized that mothers who perceive that they have more social support would adjust better to their child's illness. Therefore, social support was thought to be negatively correlated with depression and anxiety, and social support was thought to be positively correlated with marital adjustment. A hypothesis also was made based on the two categories of social support, informal and formal support. It was hypothesized that mothers would report a higher level of satisfaction with informal support than they would with formal support. From these findings, an additional hypothesis was explored: Informal sources of social support would be more effective than formal ones would be in predicting adjustment in mothers.

Participants for this study were drawn from a data set collected during a 10-year period as a part of a larger family adjustment outcome study conducted at a pediatric hematology-oncology outpatient clinic (Dahlquist et al., 1993; Dahlquist et al., 1996). Participants selected for the current study were married mothers of children diagnosed with cancer. Mothers were asked to complete various questionnaires approximately one month following their child's diagnosis in the previous outcome study. The measures examined for the current study include: 1) State-Trait Anxiety Inventory (STAI), a 40-item inventory that measures self-reported state anxiety ("how you feel right now") and trait anxiety ("how you generally feel"). 2) Beck Depression Inventory (BDI), a 21-item scale used to assess the presence and intensity of somatic, emotional and cognitive features of depression. 3) Dyadic Adjustment Scale (DAS), a 32-item scale that assesses aspects of the quality of a marriage. 4) Social Support Questionnaire, an 11-item scale asking participants to rate their level of satisfaction with 11 sources of potential social support ("how helpful and supportive each source has been to you during your child's illness").

While data collection is complete, analyses are being run. It is anticipated that analyses will be complete by the program date.

If this study finds that higher levels of social support lead to better adjustment among mothers of pediatric cancer patients, these results will support findings from other studies. Unlike previous studies, a unique aspect of the present investigation is that a distinction was made between informal and formal support, which also then were examined in relation to adjustment among mothers of pediatric cancer patients. Looking at these two categories is important because by understanding which type of support parents depend on, health and mental health professionals may help to increase this support, thereby

decreasing parents' distress associated with their child's cancer.

References:

Dahlquist, L. M., Czyzewski, D. I., Copeland, K. G., Jones, C. L., Taub, E., & Vaughan, J. K. (1993). Parents of children newly diagnosed with cancer: anxiety, coping, and marital distress. *Journal of Pediatric Psychology*, 18, 365-376.

Dahlquist, L. M., Czyzewski, D. I., & Jones, C. L. (1996). Parents of children with cancer: a longitudinal study of emotional distress, coping style, and marital adjustment two and twenty months after diagnosis. *Journal of Pediatric Psychology*, 21, 541-554.

House, J. S. (1981). *Work, Stress, and Social Support*. Reading, MA: Addison-Wesley.

Morrow, G. R., Carpenter, P. J., & Hoagland, A. C. (1984). The role of social support in parental adjustment to pediatric cancer. *Journal of Pediatric Psychology*, 9, 317-329.

Speechley, K. N., & Noh, S. (1992). Surviving childhood cancer, social support and parents' psychological adjustment. *Journal of Pediatric Psychology*, 17, 15-31.

Biochemistry and Molecular Biology

Characterization of the GTPase-Associated Region (GAR) RNA By Electrospray Ionization Mass Spectrometry

Dzovig Kolejian and Dan Fabris

Advisor: Professor Daniele Fabris

The diverse functions performed in a living cell require RNA to fold into specific three-dimensional structures. Divalent metal ions are known to participate in the stabilization of the three-dimensional folding of RNA, but there are many open questions about the location and configuration of the binding sites and the mechanism of binding.

Electrospray ionization mass spectrometry (ESI-MS) (1) has been applied successfully to the investigation of metal-chelation by proteins and looks very promising for the study of metal-RNA complexes. A systematic study aimed at elucidating the stoichiometry, the structure of binding sites and the variables affecting metal-binding requires the development of a reliable, analytical protocol. In particular, it will be necessary to test conditions that keep metal-RNA complexes stable in the low ionic strength environment, which is best suited for ESI-MS analysis.

The model system chosen for this study is the GTPase-associated region (GAR) RNA (2), a 58mer oligonucleotide present in the 50S subunit of rRNA, which is involved in the elongation cycle of protein synthesis. It has been demonstrated that GAR RNA necessitates Cd^{2+} or other divalent ions to keep its native three-dimensional structure and provide biological activity.

The 58mer will be produced by in vitro transcription of a synthetic DNA template using T7 polymerase. The polymerase was produced in house by overexpression in BL-21 *E.coli* using a PAR- 1219 vector followed by $(\text{NH}_4)_2\text{SO}_4$ precipitation and ion exchange chromatography. After RNA purification by

denaturing polyacrylamide gel electrophoresis (PAGE), GAR will be allowed to fold in presence of variable concentrations of Cd^{2+} and other divalent cations, such as Mg^{2+} and Zn^{2+} . Activity assays and melting temperature determinations will confirm the viability of the complexes produced. Solutions containing viable complexes will be used to optimize the instrumental parameters for "native conditions" ESI-MS, providing a valid method for a systematic study of metal chelation by RNA.

References:

1. "Electrospray Ionization Mass Spectrometry," Cole B. R., Ed. 1997, John Wiley and Sons, Inc. Canada.
2. Wimberly, B.T.; Guymon, R.; Mccutcheon, J.P. "A Detailed View of a Ribosomal Active Site: The Structure of the L11-RNA Complex" Cell (1999), 97 491-502.

*This investigation was supported, in part, by UMBC through its MARC U*STAR Program.*

American Studies and English **The Construction of Identity in Korean-American Literature**

Susan Lee

Advisor: Professor Jason Loviglio

The study attempts to understand how the self has been constructed in Korean-American literature written in English, and it explores the problems of Korean-American writers who try to mediate their own hyphenated existence. Along with a literary approach, the construction of the Korean-American identity in literature is analyzed using sociological and historical approaches specifically how the effects of events and circumstances surrounding this growing group of minority writers dictate how they depict themselves within literature.

The researcher explores her own unease as a Korean American trying to write her identity freely in English as she refers to Korean-American texts. Two significant Korean-American works are referenced: Younghill Kang's *East Goes West*, written during the first wave (1904-1944) of Korean immigration to America, and Theresa Hak Kyung Cha's *Dictee*, written in the third wave (1968 to present). Both works are viewed in light of how the narratives interact with the surrounding American culture, as well as the Western canon of literature and how such interaction marginalize and alienate the Korean-American identity.

As a conclusive assessment of Korean-American literature, some of the more recent works are viewed in light of contemporary sociological conditions for Korean Americans and how the researcher, as a Korean-American writer, is a part of that literary movement. The study seeks to understand how Korean Americans have written about their experiences and the circumstances that make their literature a necessity for asserting the Korean-American experience within the greater American literary context.

Political Science

The Commodification of Culture and Its Implications for Democracy

Harold A. McDougall, IV

Advisor: Professor Cynthia Hody

This presentation will explore the economic and historical origins of American consumer culture and analyze its cultural implications upon the principles and practice of democracy. Drawing upon the work of economic and cultural historians, the presentation will examine how three interrelated trends led to the development of a consumer culture in the United States. First, the newly integrated national market required that local tastes be homogenized to an extent to facilitate the sale of standardized national commodities. Second, the crisis of traditional morality caused by increased urbanization and secularization itself created space for the development of a new therapeutic morality of immediate gratification, which was advanced by a rising managerial elite. Thirdly, this elite applied Taylorist principles of a new "scientific" motivational psychology to the management of consumer demand.

These trends produced a new culture whose values were realized and attained through advertising and the consumption of commodities. This broader trend has been called the "commodification" of culture.

This presentation will chart the progress of cultural commodification and examine its relationship to postmodern cultural philosophy and evaluate Frederic Jameson's claim that postmodernism is the cultural logic of late (consumer) capitalism. Finally, the presentation will explore the implications of the economic culture of consumption upon democracy in practice and in theory.

The former will include evaluating the extent to which campaign consultants utilize principles of demand management and the extent to which political candidates themselves, become commodified.

The latter discussion will examine opposing views concerning the relationship of consumer culture to the principles of democracy. While some proponents of consumer culture argue that it supports democracy, insofar as it allows consumers to "vote with their dollars," detractors have contended that it creates passive and privatized consumer citizens who have neither the capability nor the willingness to conceptualize public goods.

Structural and Molecular Biology

Structure Determination of the HIV-1 Matrix-Capsid Fusion Protein

Yasmine Ndassa, Showieb Shuja, Chun Tang and Rossitza Gitti

Advisor: Professor Michael Summers

This work aims at determining the three-dimensional structure of the HIV-1 matrix (MA) and the N-terminal domain of the capsid (CA) fusion protein within the HIV poly-gag protein using Nuclear Magnetic Resonance (NMR) Spectroscopy. Elucidation of this structure will shed light on how gag protein is processed by the protease to form mature virus. The gene coding of the MA-CA fusion protein was amplified from complete genomic cDNA (pNL4-3) using Polymerase Chain Reaction (PCR). After NdeI and BamH I double digestion, the PCR product was inserted into the pET16b expression vector. Over-expression of fusion protein was achieved by induction of BL21- CodonPlus-RIL host cells growing in

minimal media at 37 degrees Celsius with 1mM IPTG. The protein product contains 283 residues with a 16-residues Histidine tag at the amino-terminal. With a molecular weight of 32kDa, MA-CA was purified by cobalt affinity chromatography and was eluted with 200mM imidazole. The His-tag was removed by Factor Xa cleavage, and the protein was purified further by gel filtration chromatography. A subsequent ultrafiltration step allowed concentration of the protein. This procedure was used to obtain isotopically labeled protein suitable for NMR studies. This procedure was used to obtain isotopically labeled protein suitable for NMR studies. NMR data were collected on Bruker 600 and 800 MHz instruments. The protein backbone has been assigned. Chemical shift index plot suggests that the 13-hairpin is absent in MA-CA.

References:

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American Studies and Political Science

The Role of United States Senator: Perceptions Based on Rhetoric and Reality

Bethann Ritter

Advisors: Professor Warren Belasco and Professor Thomas Schaller

The purpose of this study is to examine the role of the United States senator by looking at the perceptions of senators, Congressional scholars and constituents. Much of the existing research on the United States Congress pertains to the House of Representatives; very little exists on the Senate, likely due to the chamber's unique methods of operation. Some characteristics of the Senate are comparable to those of the House, however. Current scholarship on the House will be used to analyze and examine the Senate.

The following research questions are addressed: 1) Do senators think their role is that of legislator (lawmaker), provider of constituent services, some combination of the two or something else? 2) What do constituents expect of their senators? 3) What is the rhetoric of access? 4) How do senators perception of their role manifest itself in their work? 5) Is it reflected in their staffing patterns?

Data for the research will pertain to a sample of the Senate of the 105th Congress. This sample consists

of 16 members of the 105th Congress, representing the eight largest states that had senators up for re-election this year. I have selected this group for several reasons. First, they have the largest number of people to represent. Secondly, seven of these people were up for re-election and I want to see if and how re-election affects senators' perception of their job. The other seven senators were not up for re-election, this year, but they serve the same constituencies and, therefore, serve as a control group (i.e. perceptions and patterns could change based on different constituencies). Questionnaires were sent to each of the 16 senators. These questions ask about senators' perception of their role, their constituents' expectations of them and how they address the needs and concerns of their constituency as a member of the United States Senate. Other sources include newspapers from each state, the Congressional Staff Directory and the Report of the Secretary of the Senate, and polling data from the 2000 elections.

American Studies

The Politics of the Punk Rock Teacher: Performance and Resistance in the Mainstream Educational System

Jessica Skolnik

Advisor: Professor Jason Loviglio

This project examines the transitions involved when young people growing up in the punk rock subculture of the late 1980s to present day become teachers in the mainstream elementary/secondary school system. The project examines similarities between the "do it yourself" philosophy of punk and the liberal rhetoric of the American public educational system, as well as the ways in which punk serves to politicize everyday happenings for (generally white, middleclass, male) young people who might not otherwise be politically active.

It also looks at performance on stage in the local punk scene versus performance in the classroom (including the power relationships between audience and auteur, student and teacher). Could involvement in punk rock help form a philosophy of teaching that could lead to more egalitarian classroom organization, emphasis on multicultural education and other positive education reform? Is this a plausible goal within the framework of the current American public education system, or might teachers with their roots in punk have to look to privatized education to make any changes in students' classroom experiences?

This project takes into consideration the writing of intellectuals and education reformers such as Noam Chomsky and Henry Giroux, the writings of music critics such as Geil Marcus and Simon Frith who can place punk within its cultural context, and the work of cultural ethnographers such as Lauraine LeBlanc who have studied punk. It also grounds itself theoretically in current and historical writings on social inequities within the educational system (such as Christopher Jencks' 1968 study) and the democratic rhetoric of American public education.

I will be doing six ethnographic interviews for this project. My subjects are Jim Ventosa, current UMBC graduate student, high school Spanish teacher and ex-drummer for the punk band Allied War Effort; Daniel Gatewood, writer for Clamor magazine and organizer of a punk/hardcore educators' network; Leigh Sabol, singer and keyboardist for the punk band The Assistant and graduate student in elementary education; Colin Bane, participant in the punk scene since the late 1980s and photography/English

teacher at a Washington, D.C. high school; Jen Bane, participant in the punk scene since the late 1980s and kindergarten teacher at Sacred Heart Elementary in Washington, D.C.; and Tim Kabara, member of the Baltimore punk band The Legendary Champions, ex-history teacher in Baltimore City, now a teacher at a private high school in Baltimore County.

Mechanical Engineering

The Effects of Dehydration on the Mechanical Properties of Dentin

Robert L. Smith

Advisor: Professor Tony Farquhar

Strong teeth play an important role in lifelong human health and nutrition. Recently, it has been reported that the risk of incomplete tooth fracture increases with age [1]. Tonami and Takahashi [2] found no changes in elastic modulus or ultimate strength of old versus young dentin. However, it is known that moisture content in human teeth decreases with age [3], and the idea that moisture loss affects the mechanical behavior of teeth dates back more than 100 years [4]. Using tensile and three-point bending tests, Jameson [5] reported a difference in strain at fracture between hydrated and dehydrated dentin specimens. However, he found no difference in elastic modulus or stress at fracture. The objective of this study was to quantify the effects of moisture content on acoustic wavespeed of dentin, which can provide a useful measure of elastic modulus.

Destructive mechanical tests have severe limitations when applied to small biological tissue specimens. For example, special gripping and machining methods often are required. Due to specimen-to-specimen variability, comparisons between groups often require a large sample size. To reduce sample size, it therefore may be desirable to use non-destructive testing protocols that allow self-comparisons between different treatment levels.

For this study, ultrasonic wavespeed was determined to obtain a measure of elastic modulus as a function of hydration. Six upper molars were extracted from a one-year-old bovine and were placed in distilled water at 10 degrees Celsius. The roots were embedded in a polyester resin to facilitate gripping. The ultrasonic testing protocol required parallel-sided specimens. All six facets of a rectangular parallel piped specimen were machined using a 200 grit, diamond-cutting blade on a computer-controlled slicing saw. During this operation, a water-based coolant was used to saturate the cutting area. A total of 12 specimens was obtained. After machining, the specimens were equilibrated in distilled water at 20 degrees Celsius in preparation for ultrasonic testing. Wavespeeds were measured at several timepoints for each specimen using a pitch-catch protocol and two 5MHz contact transducers as follows. Progressive dehydration was performed by exposing the specimens to 20-degree Celsius ambient air for up to four hours. Seven specimens fractured during dehydration, and only five specimens were still suitable for ultrasonic testing at four hours.

The ultrasonic wavespeeds in the lingual-buccal direction were measured for bovine dentin specimens at 5mm below the occlusal surface. Fully hydrated wavespeeds ranged from 2,720 to 4,651 m/s with a mean (s.d.) of 3,220 (465) meters per second. After one hour of dehydration, the mean (s.d.) was 3,350 (616) meters per second, and after four hours, the mean (s.d.) was 3,843 (619) meters per second. (Note: the average moisture loss at seven days was 5.76 percent (w/w). Thus, two-thirds of the total dehydration occurred within one hour and three-quarters within four hours.) Using Tukey's multiple

paired comparisons test within a family error rate ($p=0.05$), no change had occurred within one hour of dehydration, but wavespeeds were up to 22 percent higher at four hours than they were at the fully hydrated level.

The key advance of this study was to show that non-destructive, ultrasonic testing can detect small but significant changes in elastic modulus of dentin associated with changes in hydration. Better understanding of these changes ultimately may provide useful insights into the effects of moisture loss on other mechanical properties such as ultimate strength and fracture toughness.

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American Studies and Education

Pay No Attention to the Man Behind the Curtain: What's Really at Issue in the Fight Over MSPAP

Sutton Stokes

Advisor: Professor Ed Orser

This paper situates the Maryland School Performance Assessment Program (MSPAP) within the context of standardized testing history and current practice and then explores the debate surrounding MSPAP in an attempt to characterize the ideological underpinnings of some of the arguments for and against the test's use.

The last two decades have seen a sharp increase in programs designed to compare and evaluate public schools and school systems and to change instructional approaches within those schools. At the same time, there also have been marked changes to the categories of people eager to enter into debates on education policy. While, for much of this century, specifics of curriculum design and school system administrative policies and structure were considered pre-eminently local matters best left to education professionals, such issues more recently have moved to the center of state legislative agendas, gubernatorial and even presidential campaigns. They are now closer than ever before to federal oversight and control. Republicans and Democrats alike appear not only to accept as given the need for education reform, but they also agree that large-scale standardized testing programs should be the main instruments of such reforms.

These are treacherous waters for critical, "liberated" or even just plain thoughtful education professionals to navigate-no less shark-infested than ever, but increasingly murky and deceptive. This paper examines the conversation about MSPAP with an eye toward sounding and charting these waters: What are the political and ideological underpinnings of arguments for and against MSPAP, and what are their implications? What sort of schools and teaching is MSPAP "for"? If MSPAP loses, who wins? And perhaps most importantly, where should education professionals position themselves in relation to the various sides of this debate? Can educators with philosophical and ethical objections to mandated testing afford to oppose MSPAP? Might it even be possible that they should defend it?

The paper relies on critical analysis of the public statements of, academic writing by, and personal interviews with some of the players on the MSPAP field.

POSTER PRESENTATIONS

Chemical Engineering

Process Design for Human Protein C Production Using the Superpro Simulation Language

Hessam Afshari

Advisor: Professor Duane Bruley

Laboratory data gathered for protein C will be coupled with the Superpro simulation language for an innovative approach at process design for human protein C production.

Congenital protein C deficiency is an inherited disorder that causes abnormal blood clotting. Normal blood coagulation is a complex process involving as many as 20 plasma proteins called blood coagulation factors. Rapid chain chemical reactions occur that use these blood coagulation factors to produce the insoluble protein called fibrin, which serves to stop bleeding. When any one of these blood coagulation factors is lacking or completely missing, the chain reaction does not take place normally. Protein C deficiency has been linked as a possible source of thrombosis. Protein C deficiency also will leave one at a greater risk for the development of venous thromboembolism.

Protein C-deficient people lack part of a blood plasma glyco-protein that serves to regulate blood clotting. Obtaining protein C from donated plasma can be used to treat protein C-deficient people, but it also can introduce viral infection. Increased risk of being protein C-deficient is seen in persons who have a history of, or who have a family history of, recurrent blood clots in the veins, symptoms of venous blood clots from the start of life, or use of warfarin and/or heparin type anticoagulants. There is no cure for protein C deficiency; however, the outcome is usually good with treatment.

For this process design project, a powerful simulation program titled Superpro Designer is being utilized to aid in the design of the process being developed for the production of Protein C. SuperPro Designer is a valuable tool for process design and product development. It allows many variables to be accounted for throughout the process design development. SuperPro Designer's adaptability to modifications within the design makes it an appealing tool to utilize for a design project as such. A process that has been designed cannot only be easily changed, but data that has been gathered in the laboratory can just as easily be inserted and used to run or "test" the design in question. The ability to run data through a process that has been designed is a particularly useful tool in any process design project. Having the ability to observe how a process functions with the numbers introduced can be a tremendous asset in identifying flaws and unrealistic or impossible elements of the design in question.

Data gathered from the laboratory will be introduced to the SuperPro Designer process simulation and together the two serve as a very powerful tool in developing and optimizing a process for the production of human protein C.

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Interdisciplinary Studies: Biopsychology**Developmental Model of Schizophrenia Using Acute Mitotic Insults to Neuronal Progenitor Cells****Ada Booth**

Advisors: Professor Patricia LaNoue and Professor Michael Vogel

The purpose of this study is to develop an animal model of schizophrenia through acute mitotic insults to fetal rats. This study seeks to ascertain whether mitotic insults in prenatal rats will lead to behavioral and neuroanatomical changes similar to those found in human patients with schizophrenia. Pregnant rats were injected with saline or cytosine arabinoside (AraC), an antimitotic drug, between day 13 (E13.5) and day 20 (E20.5) of embryonic development. This is a period during which neurogenesis of cortical and subcortical neurons occurs. Behavioral testing of the resulting pups was conducted on day 35 and day 56 of post-natal development. After behavioral testing was complete, the brains of rat pups either were fresh-frozen or fixed in paraformaldehyde for neuroanatomical analysis. Brains were sectioned and analyzed with respect to three measures: volume measurements of selected cortical regions, cytochrome oxidase desitometry as an indicator of neuronal activity and in situ hybridization for the NMDA NR1 receptor subunit.

To date, several brains have been stained, and measurements are in progress. When data collection is complete, analysis will be conducted to see if there are significant differences between the volumes, cytochrome oxidase activity, and NR1 binding levels of control and AraC rat brains. Finding significant changes in the ARAC rat brains similar to those changes found in human schizophrenic brains will support the validity of this animal model of schizophrenia. The animal model then can be used as a means by which schizophrenia could be studied further, providing increased knowledge of the disorder leading to better treatments of schizophrenia.

Chemical Engineering

Development of an Imaging System for Luminescent Pressure Sensitive Paint (PSP)

Heather Couvillon and Nirmala Chandrasekharan

Advisor: Professor Lisa Kelly

A multi-component instrument is being designed and assembled to test Pressure Sensitive Paints (PSPs). PSPs are chemical materials being developed to exhibit a change in luminescence wavelength and intensity upon exposure to pressure change. These PSPs will be tested in a flow chamber where light of certain wavelengths may be used to excite the material. The wavelength and intensity of the emitted luminescence from the PSPs then will be used to characterize the materials.

The system will incorporate the following instrument components: a flow chamber, monochromators, spectrometer and a computer interface. The flow chamber will allow various pressures and flow rates of water and air to be applied. Light from a xenon excitation source will be monochromated and provide the excitation light to illuminate the sample. Emission will be collected in two 20 Poster Presentations modes: (i) spectrally resolved (through a computer-controlled scan of the emission monochromator) and (ii) spatially resolved (using a digital camera and band-pass filters). A LabView graphical user interface is being developed to control the hardware components (scan speed, range of excitation and detector high voltage). In addition, the experimental parameters (flow rate, Reynolds number, sample temperature and chamber pressure) will be monitored in real time.

The system will be evaluated and tested for performance (accuracy, precision and sensitivity). The instrument components will be tested as they are built for precise movements or functions. The data gathered by the system will be validated with existing PSPs. Once validated, the system will be used for screening new samples for optimum response to water flow rates.

Sociology

Personal Health Services for the Disabled: An International Comparative Study

Melissa E. Dehn

Advisor: Professor Mary Stuart

Summary

For my research project, I conducted a participant observation study of respirator-dependent patients who live in the community in Lyon, France, and considered what U.S. policymakers could learn from the Association Lyonnaise de Lutte contre la Poliomyélite (ALLP), an internationally recognized system of home care.

Context

Medicare and Medicaid reform are two of the major health policy debates on the U.S. political agenda today. A central issue is how to integrate health and social services to serve people with chronic illnesses and disabilities more effectively. Home health care is an important component of service integration for the elderly and disabled. Personal care services play a vital role in the delivery of home care to people who need assistance with activities of daily living. Of particular interest is the role that clients can play in the organization and delivery of personal care services.

Methodology

To learn more about U.S. policy, I reviewed published literature to determine how Social Security, Medicare and Medicaid each address the issue of personal care services for the severely disabled. I then traveled to Lyon, France, where I spent a week as a participant observer with the ALLP.

Accomplishments to Date

While I was in Lyon, I lived in the home of Dr. Dominique Robert, a leading medical professional in the field of respiratory care and medical director of the ALLP. Dr. Robert graciously devoted hours of his time each day discussing my observations and sharing his insights. I spent an entire day with Dr. Robert visiting the homes of two severely disabled children, during which time I interviewed the parents, through Dr. Robert's translation. Further, I spent four days in the home of four severely disabled, respirator-dependent individuals living independently in the community. Most of this time was spent speaking with the residents and their caregivers (nurses and personal care attendants), both directly (in English) and through rough translation (French to English). I spent one morning with the nurse while she administered and explained (in English) the daily morning personal care of one of the residents. This care immediately followed the bathing of the resident and included grooming and dressing the resident and caring for the resident's tracheostomy and the tracheostomy tube.

Findings

France's health care and disability income supplementation policies enabled the adults I observed to organize their own health and personal care in a manner that (1) they are the primary directors of their own care; (2) they are encouraged to pool financial resources; and (3) they are not discouraged from or penalized for attaining additional income. All of these factors appear to increase both the level and the quality of care they receive, reduce costs in the long-run and directly increase their quality of life. French health care and disability income supplementation policies appear to facilitate integration of personal care services, cost containment, and consumer-directed health and personal care, at least for the people I observed.

Conclusions

Underlying limitations in U.S. health policy sometimes preclude severely disabled Americans from receiving necessary care. Based on my observations of the French system of care and my review of the literature on U.S. disability policy, severely disabled Americans could benefit from U.S. policymakers considering more strongly: paying for personal care services, allowing for additional income to supplement the disabled person's financial resources, encouraging the pooling of resources especially by promoting group living arrangements and allowing for consumer-directed health and personal care where appropriate. Further research could identify the types of situations where collective efforts, consumer direction and group living arrangements such as I observed in France could be successful in reducing costs and improving quality of life for severely disabled individuals.

Biochemistry and Molecular Biology

Investigation Into the Nature of Cooperative Binding Affinity Exhibited by Bacteriophage T4 Gene 32 Protein

Shital Desai

Advisor: Professor Richard L. Karpel

Bacteriophage T4 gene 32 protein (g32p) has been a model for studying single-strand specific nucleic acid binding proteins for more than three decades. This project is designed to examine the effect of certain mutations on the DNA binding behavior of the protein, specifically with respect to the cooperativity of binding to single stranded DNA. Wild type T4 gene 32 protein contains three domains: N-terminal domain, central (core) domain and C-terminal domain.

Previous experiments have indicated that the interaction between the core domain and C-domain plays a critical role in the helix-destabilizing activities of the protein. Experimental observations suggest that amino acid residues in the region from positions 201 to 253 are likely involved in binding cooperativity. Two mutants in which g32p is truncated following residue 201 or 216 have been produced and expressed; however, both are insoluble in aqueous buffer, making characterization of these mutants problematic. A third truncation mutant at residue 227 has been produced and is being purified and evaluated. The presence of the C-terminal domain of the protein (residues 253-301) is known to be involved in creating a kinetic block to helix-destabilization, and three mutants are in progress that truncate the protein at residue 293, 295 or 296.

Once these mutants have been isolated, we will be able to determine what portion of the C-terminal is in fact required for the kinetic barrier to helix-destabilization. In addition to the importance of the C-terminal domain, residues 110 to 114, which are referred to as the internal LAST motif, are believed to be involved in intra-molecular protein interactions and DNA binding. Mutants have been produced that rearrange the placement of the residues between positions 110 and 114 to see if the binding parameters of the protein are affected. Further chemical analysis of all the mutants is in progress, including DNA melting assay experiments and fluorescence quenching analysis, to determine the binding activities of the mutant proteins.

Psychology

Investigation of Potential Mechanisms of High-fat Diet Induced Overeating and Weight Gain

Sweta Dharia

Advisor: Professor Zoe Warwick

Previous studies have found that diets high in fat promote greater weight gain than do diets high in carbohydrates (Warwick and Weingarten, 1993). Diets high in fat are generally higher in caloric density than diets high in carbohydrates are, which may contribute to the greater weight gain. The purpose of the present study was to further explore the overeating and weight gain induced by high-fat diets. The following variables were examined: micronutrient content, the fat-to-carbohydrate ratio and diet caloric density.

Experiment 1 investigated whether micronutrient supplementation (vitamins and minerals) affected

meal size. Two liquid diets that have been used in previous research, high fat (HF) and high carbohydrate (HC), were supplemented with micronutrients. Fifteen rats consumed each of these diets (HF, HF+ Micronutrients, HC, HC + micronutrients) during separate 30-minute intake tests with counterbalanced testing order. Results showed a main effect of diet: Rats ate more of the HF diet than the HC diet, $F(1,14) = 25.8, p < 0.05$. Micronutrient supplementation had no effect on intake.

Meal Size: Grams

mean

(standard error)

Diet		HF	HC
Micronutrients	Yes	14.9 (1.0)	11.2 (1.2)
	No	14.5 (3.9)	12.5 (1.4)

Experiment 2 investigated the dose-response relationship between dietary fat content and caloric intake/weight gain. The HF and HC diets were mixed at different ratios (100:0, 75:25, 50:50, 25:75, 0:100) yielding five diets ranging in fat content from 60 percent to 17 percent of calories. Forty-five rats were divided into five weight-matched groups; each group ate one of the diets for 16 days. A main effect of diet was observed on both average caloric intake, $F(4,40) = 4.4, p < 0.05$ and weight gain, $F(4,40) = 4.7, p < 0.05$. Post-hoc tests revealed a threshold effect. The diets ranging in fat content from 17 percent to 49.25 percent promoted equivalent caloric and weight gain. However, the 60 percent fat diet promoted significantly higher caloric intake and weight gain.

Dient

mean

(standard error)

HF: HC	100:0	75:25	50:50	25:75	0:100
Fat Content % of calories	60%	49.25%	38.5%	27.75%	17%
Intake (g)	127.8 (3.7)	108.1 (1.9)	104.4 (1.7)	96.1 (1.9)	101.8 (2.8)
Weight Gain (g)	56.3 (11.1)	29.8 (5.7)	24.3 (5.3)	16.4 (5.5)	20.1 (7.3)

Experiment 3 examined the effect of dietary dilution. The HF and HC diets were prepared at three dilutions (2.3, 1.15 and 0.575 kcal/ml). Rats consumed one of these diets for 16 days (9-10 rats per group). Preliminary findings indicate that rats fed the HF diets consumed more than the rats that were fed the HC diets, which was consistent with previous results. Diluting the diets did not affect weight gain. This finding was somewhat surprising, and a replication is in progress.

Daily intake: kcals
mean
(standard error)

kcaljml		2.3	1.15	0.575
Diet	HF	129 (9.7)	157.1 (9.6)	157.7 (3.5)
	HC	116.4 (7.3)	109.6 (9.3)	111.6 (3.9)

Weight Gain: grams
mean
(standard error)

kcaljml		2.3	1.15	0.575
Diet	HF	44.0 (12.2)	38.3 (8.8)	45.0 (3.5)
	HC	21.2 (7.3)	21.1 (10.8)	16.8 (6.8)

Summary of findings: 1) Micronutrient supplementation did not affect intake; rats ate a larger meal of HF versus HC independent of its micronutrient content. 2) The intake-enhancing effect of dietary fat was not linear, but instead reflected a threshold effect. 3) HF diet produced greater intake across a range of caloric densities. Excessive intake of dietary fat is associated with numerous negative health consequences, and thus it is important to understand why high-fat diets are over-consumed.

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Biological Sciences

Advanced-stage Mammary Tumor Suppresses Immunity

Mileka R. Gilbert

Advisor: Professor Suzanne Ostrand-Rosenberg

Our research group has generated a tumor cell-based vaccine (immunotherapy) to enhance T-cell mediated immune responses against the 4T1 mouse mammary carcinoma. This vaccine has been very successful in reducing advanced metastatic disease disseminating from primary 4T1 tumor that has been established two-four weeks prior to the initiation of immunotherapy. As a result, survival is increased; however, the animals eventually succumb to the metastatic tumor. Previous studies have suggested that normal immune functions are suppressed in tumor-bearing individuals as a direct result of the tumor cells. Therefore, we have hypothesized that the 4T1 tumor suppresses immune function in our system.

To test this hypothesis, we have designed several experiments to test normal immune functions in naive

versus tumor-bearing 8AL8/c mice. In particular, we have measured in vivo responses to superantigens such as Staphylococcal aureus enterotoxin 8 (SE8) and lipopolysaccharide (LPS). SE8 and LPS induce toxic shock syndrome in 8AL8/c mice through T-cell and macrophage dependent mechanisms, respectively. In both cases, toxic shock syndrome is characterized by gross weight loss resulting from increased tumor necrosis factor-alpha (TNF-a) in serum.

Preliminary data from in vivo studies suggest that T-cell function and not macrophage function is suppressed in early- and late-stage tumor-bearing animals. If tumor-bearing animals are immunosuppressed, the ability of these mice to reject allogeneic 816 tumor may be compromised. 8AL8/c mice with three- or four-week established 4T1 tumors were challenged with 816 tumor. Preliminary data show that 816 tumor grows to a larger size in mice carrying the 4T1 tumor in comparison to mice challenged with 816 alone. These data suggest that individuals with large tumor burdens may be significantly immunosuppressed, making it difficult to generate effective cancer vaccines.

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Biological Sciences and Psychology

Ultrastructural Organization of the Dopaminergic Terminals in the Caudate Nucleus of Schizophrenic Patients

Tida Kumbalasiri, L. Kung and M.M. Force

Advisors: Earnestine B. Baker (UMBC mentor) and Rosalinda C. Roberts (UM Psychiatric Research Center)

This study was conducted to examine the synaptic organization of dopaminergic terminals in the caudate nucleus of schizophrenic cases. Tissue from schizophrenic cases (SZ) (n=8; mean age, 44.0±9.9 years; mean PMI, 5.1±1.8 hours), and normal controls (NC) (n=6; mean age, 37.8±10.3 years; mean PMI, 5.3±1.5 hours) was obtained from the Maryland Brain Collection. Fixed human brain tissue was processed for the immunocytochemical localization of tyrosine hydroxylase (TH) to identify dopaminergic terminals, prepared for electron microscopy and analyzed using stereological methods. The mean density of the TH+ synapses per 10µm³ was 0.351±0.141 (SZ) and 0.303±0.09 (NC), respectively. Approximately one-third of the TH+ terminals formed symmetric synapses onto dendritic shafts, and two-thirds synapsed onto spines in both groups. TH+ terminals formed: 12.1 percent (NC) and 12.6 percent (SZ) of all the striatal synapses; 39.5 percent (NC) and 36.0 percent (SZ) of all symmetric axodendritic synapses; 53.0 percent (NC) and 60.0 percent (SZ) of all symmetric axospinous synapses. While subgrouping the schizophrenic cases by subtype did not show differences, the subgrouping by antipsychotic drugs (APO) appeared to show an effect. The density of TH+ axodendritic synapses in schizophrenic cases treated with atypical APO (0.045±0.017) was lower than 1) Schizophrenic cases treated with typical APO (0.130±0.035, p<0.05) and 2) normal cases (0.108±0.044, p<0.05). The results suggest that abnormal variation in the density of the TH+ synapses in schizophrenic cases is probably a drug rather than a disease effect. Supported by NARSAD and MH60744.

Economics and Political Science

The Costs and Implications of Economic Sanctions

Kristen Locatelli

Advisor: Professor Cynthia Hody

Economic sanctions have been used frequently as a means of coercion, a type of "economic" force aimed at securing one state's compliance to the demands of one or more other states. All the current research on economic sanctions suggests that sanctions are costly to all parties involved-to the target states, certainly, but also to the state that imposes them. Elementary trade theory partly explains why. In a competitive market, free trade produces an efficient allocation of resources, any restriction of trade necessarily reduces welfare in both trading countries. Other costs of sanctions include their political and social costs, such as deteriorating sanitation and health care. Despite the clear evidence of their costs, states still rely on economic sanctions to advance their foreign policy goals. Why is this so?

The obvious answer to the above question is that sanctions represent a middle ground in international politics; they are more severe than mere verbal condemnation, but less severe than military force. Moreover, with international support and well-defined goals and objections, sanctions can be used successfully. My research explores two cases where sanctions have been employed: Cuba and South Africa. The former is an example of where sanctions have been unsuccessful in meeting the goals the United States hoped to reach, while the latter is an example of the successful use of sanctions. I juxtapose these two case studies to identify the necessary factors for successful use of economic sanctions as an instrument of foreign policy, as well as those factors that inevitably will doom sanctions to failure.

In my presentation, I would like to inform the audience of the use of sanctions as an economic tool. Many Americans are aware of the increasing use of sanctions, but not much information is given about the actual effects of sanctions on the target country. I would like to outline some possible guidelines that a government should use when implementing sanctions to increase the benefits and decrease the risk. The use of posters and visual aides will facilitate my presentation.

Chemistry

Stereochemistry of the Hydrolysis Reactions of Para-Substituted Styrene Oxides

Sasha A. McGee

Advisor: Professor Dale L. Whalen

In this investigation, the hydrolyses of chiral para-substituted styrene oxides have been studied to determine the stereochemistry of epoxide ring opening by acid-, base- and non-catalyzed reaction pathways. Styrene oxide is a biological metabolite of styrene, a widely used industrial hydrocarbon that is a cancer suspect reagent. The adverse biological effects of styrene are attributed to the epoxide metabolite. A greater knowledge of the stereochemistry of epoxide ring opening by solvent is essential to understanding the mechanism of its interaction with biomolecules such as DNA. Methods involved in this study include the synthesis of a chiral epoxide from the corresponding chiral monotosylate, hydrolysis of the epoxide, derivitization of the dial product with a chiral compound and 1 H-NMR analysis of the derivatives to determine the configuration at the benzyl carbon. A summary of the

stereochemical outcomes of the hydrolyses of these substituted styrene oxides will be presented.

*This investigation was supported, in part, by the NIH, National Research Service Award GM 08663 from the MARC U*STAR Program at UMBC.*

Biochemistry

Stereochemistry of Epoxide-Chlorohydrin Transformations

Nkabuije Maduiké

Advisor: Professor Dale L. Whalen

The current research project seeks to establish the stereochemistry of several chlorohydrins formed from the reactions of arene oxides with hydrochloric acid. Two epoxides, indene oxide and tetralin oxide, will be synthesized and treated with hydrochloric acid. The products from these reactions are mixtures of stereoisomeric chlorohydrins in which the hydroxy and chloro groups possess cis and trans stereochemistry. The cis and trans chlorohydrins formed from both epoxides will be separated and analyzed by ^1H nuclear magnetic resonance spectroscopy. The reactivities of the cis and trans chlorohydrins in base solutions will be determined to establish the relative stereochemistry of the two stereoisomers. This project is part of a larger study of the mechanism of chemical carcinogens and the roles that epoxide and chlorohydrin metabolites of polycyclic aromatic hydrocarbons play in cancer initiation.

*This investigation was supported, in part, by the National Institutes of Health, National Research Service Award GM 08663 from the MARC U*STAR Program at UMBC.*

Biological Sciences

The Role of Endogenous Serine Residues in the Arrestin-mediated Deactivation of Bovine Rhodopsin

Marlene Mathews

Advisor: Professor Phyllis Robinson

The phototransduction cascade starts with the activation of rhodopsin (Rho), initiated by the absorption of a single photon and the exchange of GDP for GTP by the G protein transducin. During deactivation, rhodopsin kinase (RK) recognizes the activated Rho (Rho*) and phosphorylates serine (Ser) and threonine (Thr) residues in the carboxyl tail. The phosphorylated rhodopsin then becomes a substrate for the regulatory protein arrestin (Arr). Binding of Arr prevents Rho* from activating more transducin. The objective at hand is to investigate the importance of each Ser tail residue in the deactivation process. Previous studies showed that a Rho mutant with a single Thr at 340 (T340A) and a mutant with only endogenous Ser (S334/S338/AS343) were unable to be quenched by Arr. On the other hand, a mutant with endogenous serines and a Thr at 340 (S334/S338/S343/QT340) exhibited close to wild-type quench. Ser residues in the Rho carboxyl tail systematically were substituted with non-phosphorylatable residues. The Rho mutants will be examined for their ability to be quenched by arrestin in a GTPγS-binding assay, shedding light on which serines are necessary and sufficient for wild-type deactivation of rhodopsin.

*This investigation was supported, in part, by UMBC through its MARC U*STAR Program at UMBC.*

Biological Sciences

What Determines Processing at Site AO in Mouse Precursor Ribosomal RNA?

John Radtka

Advisor: Professor Nessly Craig

The essential nucleotides and RNA structure that influence the first processing cleavage event in the maturation of mouse ribosomal ribonucleic acid (rRNA) were examined. All proteins in living organisms are synthesized on "machines" known as ribosomes. A ribosome is composed of three specific rRNAs and associated ribosomal proteins. When the precursor to these rRNAs originally is transcribed from chromosomal DNA, it is in the form of one long precursor molecule. But before the rRNA can be incorporated into a ribosome, the rRNA precursor molecule must be cleaved into the smaller 18S, 28S and 5.8S pieces (Eichler and Craig, 1994). It has been determined that the very first processing cut in the mouse precursor rRNA occurs at either nucleotide +650 or +675, which occurs at the beginning of a conserved 200-nucleotide sequence. It has been shown that the nucleotides in this region form a single stranded loop at the end of a stem with bulges, and that this loop is necessary in the successful processing of the rRNA (Craig et al., 1991). However, like many aspects of ribosomal RNA processing, it is still unclear as to what properties of the RNA serve as recognition signals used in the cleavage processing of the RNA. Among the various possibilities, it is possible that particular nucleotides are crucial, the nature of the folded secondary structure is important or some combination of the two features is used.

To gain a better understanding of whether the nucleotide sequence or the secondary structure of this region (or both) is essential for the recognition of the cleavage site, systematic mutations were made to the nucleotide sequence of the stem loop structure. The selected mutations first were made in DNA because DNA is used as a template to synthesize the desired rRNA. A computer program was utilized to determine how each mutant affects the secondary structure of the folded rRNA. To determine the processing efficiency of these mutated rRNA molecules, a cell free rRNA processing system was used (Craig et al. 1991). By comparing the processing results of the mutated rRNA with that of wild-type rRNA, the processing efficiency can be determined. It then can be determined how the processing efficiency was affected by nucleotide changes and any change in the secondary structure of the rRNA. Preliminary results from these experiments reveal that the nucleotide sequence of the loop, as well as the stem, may be important in the primary processing event of rRNA.

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Computer Engineering

Design, Construction and Application of a Wearable Computer

Ryan Robucci and Ernesto Staroswiecki
Advisor: Professor Andrew M. Veronis

Wearable computers are the next step in the evolution of the relationship between computers and humans. Instantly available, always on and running and aware of the setting, and state the user is in, these devices would be insulted if you called them just computers. We are exploring the possibilities of a wearable computer that everybody will use. Design has involved extensive research and experimentation with unobtrusive heads-up displays; single-handed key input devices and miniature, low-power computer architectures. Integrating this with wireless technologies also expands the realm of information access. We will present our solutions with pictures and specifications of our design. On the other side of the human-computer interaction is, of course, the human. The question is not really what can this computer do, but what can the user do with it. We are looking into the capacity of the user to perform every-day tasks while using her computer to, for example, answer email or check a schedule. Our computer will be used by non-technical students of our university, who will report on their experience by use of questionnaires and interviews. In conclusion, we will be presenting findings on the advantages, promises and also limitations of this new mobile technology.

Psychology

Patterns of Child Behavioral Distress Among Children Undergoing Invasive Medical Procedures

Cynthia D. Rossell, Krista M. Smith, Jennifer Pearce and Marni C. Switkin
Advisor: Professor Lynnda M. Dahlquist

Recent pediatric psychology research has focused on ways to reduce the psychological distress that accompanies many painful procedures (Dahlquist, 1992; Elkins & Roberts, 1983). Typically children with chronic medical conditions experience repeated invasive medical procedures that may lead to various manifestations of both overt and covert distress. To date, the majority of research examining child distress during medical procedures has either focused on overall observable distress levels across the entire duration of the procedure, or distress levels during discrete phases of the procedure (e.g., anticipatory, procedural, recovery). For the most part, these studies have attempted to identify child characteristics that appear to be associated with distress, including child age, gender, medical diagnosis, and length of time since diagnosis. In contrast to looking at overall levels of distress, few researchers have investigated the individual patterns of distress that a child might exhibit. Based upon clinical observations, two children could potentially obtain equivalent distress scores, but present with distinct patterns of distress (e.g., a continuous low level of distress throughout the procedure vs intermittent periods of higher intensity distress).

The purpose of the current study was twofold: [1] to identify and empirically document various patterns of distress observed in children undergoing repeated invasive medical procedures and (2) to determine if systematic differences in pattern type occur across different types of procedures. Forty-six children undergoing repeated painful medical procedures for chronic medical conditions participated as part of a larger longitudinal study designed to compare the effects of different treatment approaches on children's procedure-related distress. Participants underwent between one and seven medical

procedures before psychological treatment, and only these baseline procedures were utilized for the current study. One hundred and forty one procedures were observed, including 73 venipunctures (IV), 51 portacath accesses (PC), and 17 intramuscular and subcutaneous injections (IM/SQ). The sample was 70% male; child age ranged from 2 through 10 years ($M = 5.96$, $SD = 27.70$). Sixty-percent of the children were Caucasian and 35% were African-American. Child medical diagnoses consisted of childhood cancer (52.5%), hematological disorder (e.g., sickle cell disease) (22.5%), and other chronic conditions (e.g., immunodeficiency, growth hormone insufficiency) (22.5%).

All baseline observations were video-taped over a 2-year-period. Trained research assistants evaluated the medical procedures from the time the child entered the examining room until the painful part of the procedure began (i.e., needle insertion) and recorded at what point during the procedure the child became observably distressed (e.g., entering the room, physical positioning for the procedure, removal of clothing, and procedurally related events, such as cleaning the injection site and the actual needle stick). Distress was defined as any time the child cried, screamed, yelled, or refused to comply with parent or medical staff requests (either verbally or nonverbally). Once all observations were coded for the presence or absence of distress across the various time points during the procedure, patterns of distress were identified.

Examination of the observations yielded five distinct pattern types of distress: (1) calm (child did not exhibit any distress throughout the entire procedure), (2) distress early on and continuous (child became distressed when entering the room, during physical positioning, or removal of clothing and remained distressed throughout the remainder of the procedure), (3) procedurally distressed (child became distressed when a procedurally related event (e.g., needle stick) occurred), (4) intermittently distressed (child alternated between periods of distress and calm throughout the procedure), and (5) distressed except for needle stick (child became distressed at some point before the needle was inserted, but was calm for needle insertion). Across the 141 procedures observed, 45% were classified as calm, 25% as distress early on and continuous, 11% as procedurally distressed, 13% as intermittently distressed, and 7% as distressed except for the needle.

Preliminary analyses of distress pattern type by procedure type utilizing a maximum of three baseline sessions per subject revealed apparent group differences ($N = 108$). While these results are limited by the small number of participants in each group, approximately 50% of the children undergoing IV's ($N = 61$) or PC's ($N = 36$) remained calm throughout the procedure. Of the children who did get distressed during an IV or PC, 25% of them were distressed early on and remained distressed and 10% were procedurally distressed. In contrast, none of the children undergoing an IM/SQ ($N = 11$) remained calm during the procedure. The majority of these children (45%) were distressed early on and continuously and an additional 27% were procedurally distressed. Given that distinct pattern types of distress emerged for different types of procedures, replication of the current study with more participants seems warranted. If patterns of distress are replicable, this could have implications for the etiology of anxiety reactions to medical procedures, as well as differential responses to distress management interventions.

Microbial Genetics

Bacteriocin-like Activity of *Bacillus pumilus* Plasmid pPL10

Jason Skinner

Advisor: Professor Paul S. Lovett

Bacterial pathogens have plagued humanity for centuries. Since the discovery of antibiotics in the 1940s physicians have become able to treat bacterial infections because the drugs selectively inhibit bacterial growth. While antibiotics are effective, their usefulness decreases as resistant bacterial mutants arise. Therefore, new antimicrobial agents must be identified (1). Bacteria that are a natural source of antibiotics employ small "killer" molecules to ensure their position in an ecological niche. We have noted the presence of one such "killer mechanism" in *Bacillus pumilus*.

Bacillus pumilus W20 contains the 7.0 KB plasmid pPL10, which specifies a killing function toward *B. pumilus* strains lacking the plasmid. Six open reading frames (orfs) were identified on the plasmid by DNA sequencing. Only orfs 3 and 4 did not show extensive homology to known genes. Careful inspection of the orf 3 translation sequence showed a small region with similarity to a known bacteriocin from a Gram-positive bacterium not closely related to *Bacillus*. Orfs 3 and 4 were cloned into the small drug resistance plasmid pUB110 and introduced into a plasmid-free *B. pumilus* strain. The resulting construction exhibited weak killing activity. We are attempting to restore full killing activity by cloning orfs 3 and 4 with other candidate genes found on the pPL10 plasmid.

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Biological Sciences

Examination of the Feeding Behavior of *Manduca Sexta*: Determination of the Caffeine-glucose Concentration Matrix

Raj Stewart

Advisor: Professor Frank E. Hanson

The purpose of this study is to examine the feeding behavior of the tobacco hornworm, *Manduca Sexta*, through the observation of response to binary compounds in a controlled environment. Previous research has shown that the hornworm is capable of making deterministic choices between classes of plants, which have been delineated as favorable host types (mainly of the family *Solanaceae*, such as tomato), acceptable non-hosts (including cowpea) and unacceptable non-hosts (i.e., canna) (Yamamoto and Fraenkel, 1960).

Because of the chemical complexity of the plants on which the hornworm feed, each phase of the experimentation is best expedited by limiting a phase to one or two chemical stimuli. These experiments use a feeding stimulant, such as glucose or inositol, and a deterrent, such as caffeine, as stimuli. The research questions asked during this particular phase of experimental testing were:

1. What are the preference levels for glucose and caffeine compounds?
2. What are the individual feeding thresholds for glucose and caffeine?

3. What are the stimulant or deterrent characteristics of these two compounds?
4. What are the thresholds for binary compositions of glucose and caffeine?
5. How do these observed thresholds relate to chemical levels found in the insect's natural environment?

To obtain experimental data, a standard two-choice feeding test arena was developed, allowing for the circular arrangement of two distinct selections in A-B-A-B-A-B format. A compound matrix was developed to incorporate multiple mixtures of caffeine and glucose, as well as unary solutions of the two compounds. Rather than examine response to solid chemical compounds, the natural environment was simulated using dilute solutions of chemicals in water, applied in 75 μ l aliquots to small Whatman paper discs. Upon creation of the appropriate feeding arena, one insect was exposed to the experimental arena and subsequently monitored during a 24-hour time course at varying intervals using a camera bay/computer-photo capture arrangement. Timestamp computer images then were observed, and feeding amounts for each type of solution were recorded. Amounts eaten were taken in relation to a Tso point, at which half of one solution type was consumed by an insect. Data were taken in sets (n ~ 20 insects) and used to generate feeding profiles for each level of the feeding matrix.

Data will be analyzed statistically to generate an overall feeding profile for the binary mixtures. It is our hope that these data, in concert with other results from our lab using other stimuli such as inositol and KCl will provide a more accurate view of the feeding behavior.

Future research proposes to investigate the physiological basis of these behavioral data using electrophysiological techniques. These findings may help to elucidate the taste sensory mechanism in *Manduca Sexta* and may be applicable to other insect species as we seek to further our knowledge of insect feeding behavior.

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Molecular Biology /Physiology

Mutagenesis Analysis of Ribosomal Proteins L4 and L22

Andre Walker

Advisor: Professor Janice Zengel

E. coli is the model of most of the scientific community's study of bacteria. Although it is part of the natural flora of the human gastrointestinal tract, if unchecked, the organism could become pathogenic. Moreover, there exists a host of other pathogenic species of bacteria whose basic structure and physiology is very similar to that of *E. coli*. Because of the extensive study conducted by this bacterium, much is known about it. However, much less is known about the physiology of other bacteria. If more can be learned about *E. coli*, more can be understood about other organisms. This is especially true for ribosomes because they are highly conserved across species. Site-directed mutagenesis was used to

evoke specific changes to the DNA, and, therefore, the amino acid sequence of the L4 and L22 proteins. Pulse labeling and growth curve studies were conducted on these mutants to see how ribosome assembly and autogenous regulation of the S10 operon are affected by the L4 mutations. L4 proteins harboring a 26 amino acid deletion in a conserved region of the protein were able to assemble into ribosomes and translate bacterial proteins.

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Chemistry

Development and Application of Synthetic Peptides as Additives for the Improvement of Separations of Carbohydrates and Glycosylated Compounds

Calvin Williams

Advisor: Professor William R. Lacourse

Interest in the study of biologically relevant carbohydrates and glycoconjugates has led to much research into the isolation of these compounds from biological matrices and their structural analysis. However, due to the difficulties in their separation and detection, arising from their polarity and lack of a chromophore or other detectable constituent on these compounds, current techniques suffer from low selectivity and sensitivity. It has been shown that naturally occurring proteins, for example lectins, can bind to specific carbohydrates (1), and that only a small linear portion of these lectins are required for the carbohydrate binding ability of these compounds (2).

This project will study fundamental aspects of carbohydrate/peptide binding using two approaches. First, by separating, using capillary electrophoresis, a sialic acid binding hexapeptide, SPYGRC, in a series of buffers containing increasing amounts of sialic acid, peptide concentration will be measured using ultraviolet absorbance. Second, this sialic acid binding hexapeptide will be added to a mixture of carbohydrates, and its ability to improve separation will be evaluated.

The techniques and information gained from this project then will be applied to other carbohydrate binding peptides from which a line of synthetic peptide additives will be created for use in improving current carbohydrate and glycoconjugate separation techniques.

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1. Heerze, L. D.; Smith, R.H.; et.al. "Utilization of sialic acid-binding synthetic peptide sequences derived from pertussis toxin as novel anti-inflammatory agents" *Glycobiology* 1995, 5, 427-433.
2. Yamamoto, K., et. al. "Purification and characterization of a carbohydrate-binding peptide for *Bauhinia purpurea* lectin" *FEBS Letters* 1991, 281, 258-262.

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Chemistry

The Strain Energy of Fluorinated Cyclopropanes: Quantum Chemical Realization of Homodesmotic, Diagonal and Ultradiagonal Approaches

Diana N. Zeiger, Maria Victoria Roux and Rafael Notario

Advisor: Professor Joel F. Liebman

The complete series of fluorinated cyclopropanes (0-6 fluorines) were studied by ab initio (Hartree-Fock) quantum chemical calculations with the 6-311G* * basis set with explicit zeropoint energies and thermal corrections. From these calculated total energies (and the thermochemically related enthalpies) and those of appropriate reference species, the strain energies of these cyclopropanes were calculated. Strain energy is itself not a measurable quantity; it therefore must be derived by comparison to definitionally strainless reference species. Three approaches were used to determine the strain energy: the diagonal, ultradiagonal and homodesmotic methods. Each of these methods is based upon the concept of "groups" derived from these definitionally strainless compounds. Reference species for the diagonal and ultradiagonal calculations consisted of fluorinated cyclohexanes; those for the homodesmotic approach consisted of fluorinated propanes and pentanes. The results obtained from these calculations are consistent with the earlier experience (both experimental and computational) that hexafluorocyclopropane is considerably more strained than the parent hydrocarbon; other comparisons are thwarted by lack of experimental data. The applicability of each of the three methods of calculating strain energy was assessed, and it was found that strain energy determined by the three methods varied. However, the diagonal and ultradiagonal methods proved to be in good agreement with one another.

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ARTISTIC PERFORMANCES

Music

Church Cantata, Ich will den Kreuzweg gerne gehen
Georg Philipp Telemann (1681-1767) for tenor, flute and continuo
UMBC Department of Music Collegium Musicum: Baroque Ensemble No.1
Gregory Lazzaro, bass
Theresa Lasher, flute
Nathan Knauer, continuo
Advisor: Professor Joseph Morin

Georg Philipp Telemann's Ich will den Kreuzweg gerne gehen is an example of the church cantata, a genre that became a prominent form of musical expression within German Lutheran worship during the 18th century. Crafted around biblical texts, church cantatas were composed for each of the 54 feasts in the yearly cycle of feasts that forms the core of the Lutheran liturgy.

As a genre, the cantata was developed by Italian composers in the early 17th century as a form of chamber music that typically presents a narrative text on lyric, dramatic or religious topics, although most often it concerns unrequited love. The sections of text that convey the story-line are cast in recitative-a half-sung, half-spoken form of song-while sections of text that depict emotional reaction to the story's action are sung as melodious arias. Featuring a voice supported by a small instrumental ensemble, performance was non-theatrical.

As inherited from the Italians, the cantata lent itself well to the German language and musical style. Telemann's work is characterized by clearly etched melodies; driving, energetic rhythms; and by the German proclivity for counterpoint (really a feature of sacred music in general), which renders the voice and flute melodies more as an equal duet than as a vocal line with a flute accompaniment. As with Johann Sebastian Bach, Telemann composed hundreds of these church cantatas and published four complete cycles with reduced scoring, making performance of these works possible in small churches and private homes with modest musical means. As it stands, this work is representative of the most complex vocal chamber music characteristic of German Baroque composers.

Telemann's Ich will den Kreuzweg gerne gehen was written for the Feast of the Cross, which, in the Lutheran liturgy, takes place the 21st Sunday after Trinity Sunday. Its text makes plain the symbolism of Christ's cross-its importance to Christian theology, its connection to God and Christ, and its representation as a ladder that connects earth to heaven.

Ich will den Kreuzweg gerne gehen
Telemann

Georg Philipp

Aria:

I gladly want to go to the cross; I know that there God's hand leads me. The nearer to the cross we stand, the closer we are connected to God. Whom it selected as an adopted child, by whom the cross is already regarded. Yet whosoever wishes to uproot it must be called a reprehensible villain.

Recitative:

Oh, would the fruit of the cross be so considered, which one joyfully adopts, if God only brought the same. What God does is surely done. Therefore the cross cannot be evil, other wise it would not let God, the pious one, come. He gives the bitter cup, which tastes nevertheless sweet. There the heart is aroused to be more desirous of God to ask that which one would think little of otherwise. O pleasant burden, the Christ carried! I write myself thereby into the book of honor to be like him in this way. Where there is no cross, there is no Christ. Thus Christ is not found there because these three are bound on all sides with ropes of the love.

Aria:

I kiss the pole with joyful courage, which gives pure pangs of love. The heart winces with the myrrhs of suffering because if God grieves outwardly, the soul must nevertheless win the sweetest comfort from the inside.

Recitative:

And indeed, what say I further? The cross is my ladder to heaven, whereupon I climb to God. As soon as I see, I thrust it back behind me. The cross remains the connection on earth. In heaven nothing more of it may belong there.

Aria:

Oh, my welfare, I want still tomorrow or today to be taken up to heaven! Get me yet always there, because my longing never stops until I have come to you. Is my departure not soon at hand? Give me of course the answer: Yes, yes, yes!

Artistic Statement:

The UMBC Collegium Musicum, a small musical ensemble at UMBC, provides students with the opportunity to explore Baroque music. The repertoire of cantatas, which forms part of the focus of the collegium, requires considerable study and research to bring these works back to life in an appropriate musical manner. One simply does not "play and sing" these pieces of music, but recreates them using methods of vocal production and styles of instrumental technique that replicate practices of performance used in the 18th century. Much of the basic information that one finds in modern musical scores is absent by convention from their 18th-century counterparts. Thus, the kinds of research that must be carried out to perform this repertoire range across every feature of the music, from dynamics, phrasing, articulation and tempi that should be applied, to the particular temperament appropriate to the harpsichord. The vocalists as well not only grapple with foreign-language texts, but also with aspects of old pronunciation and expression. By working in this intimate ensemble, students collectively are able to research, rehearse and achieve artistically satisfying performances of the Baroque period. Given all the demands that must be met, the performers in the ensemble become co-creators rather than simply interpreters. As such, Baroque music is created anew with each performance. The music of the high

Baroque represents a specialized repertoire with its own sets of performance and interpretational challenges. This performance thus demonstrates those challenges and their mastery by students in the Department of Music at UMBC.

Music

UMBC Student Russian Choir

Kassie Baldwin, Benjamin Barad, Lyudmila Bord, Albina Denisyuk, Yelena Makhnichenko, Karla Martinez, Kim Niemeyer, Ronald Pinkley, Vitali Remeslennik, Denis Strekalov, Arthur Swartwout, Yana Vesnovsky and Ryan Wixom

Advisor: Professor Steven Young

Chorus Director: Slava Liberman

The purpose of this presentation is to demonstrate how the UMBC Student Russian Choir not only benefits the overall student population at UMBC, but has the potential to become a community public relations resource that is thus far untapped by UMBC.

Participants of the UMBC Student Russian Choir come from a cross-section of the student population, and membership is not restrictive or limited in any way. In fact, participation in the choir has more than doubled since last semester. All that is required is a strong desire to sing both traditional and contemporary Russian songs. The choir is under the direction of Slava Liberman, who was a music professor in Russia immigrating to the United States. Choir members include students from the Russian language department, native Russian speakers and students who are majoring in music. For many of the members this is their first experience in a formal choral setting. Student participants meet on their own time once a week on Mondays. While reasons may vary as to why students choose to participate, for non-Russians it is a chance to experience Russian culture and tradition, and for Russian students it is a chance to keep their customs and traditions alive in their new homeland.

If the performance goes as planned, I would hope that the value to UMBC will be recognized and that the choir both would be supported and encouraged to expand its performances both on and off campus.

ARTISTIC EXHIBITS

New Genre

Book Arts

Chase Ayres

Advisor: Professor Irene Chan

"artist. I am a designer. I create to influence, to utter, to engage. I encourage reaction to my designs. My products are an expression of myself. I draw vision from fine art, music and pop culture. as a graphic designer, I am often restricted to a two-dimensional piece of paper; my artist books are a way to introduce a more three-dimensional interaction with the pages. My books are not to be just read, they are to be experienced."

New Genre

Book Arts

Christen Higgins Clougherty

Advisor: Professor Irene Chan

"As a senior at the University of Maryland, Baltimore County, I am continually working on my newfound interest in artist bookmaking. Similar to the other disciplines that I have studied in the past, including dance, sculpture and performance art (specifically with my company, Thundersmith Industries, Inc.), artist bookmaking explores an experiential component.

With great focus, I keep my hands busy by building creations that have the unique aim to blend unusual materials in order to convey a harmonious message. Only being able to look at art and not to touch it limits the viewer's understanding of how all the elements work together. And so I am drawn to bookmaking—an art form that demands the participation of the viewer, it becomes an experience for more than just the eyes. Pushing the limits of what the term book defines is both a challenge and the precise way that I gain most satisfaction from my creating."

Interdisciplinary Studies: Judaic Studies and Photography

Faces of the Holy Land

Aaron Eisenberg

Advisor: Professor Jonathan Finkelstein

Israel is a small country in land area. It does not compare in size to many other Asian and European nations. It is for this reason that Israel is such a special and remarkable place. In no other part of the world can one find so many different peoples living in such a small place. On a walk down any street in an Israeli city, one will notice Israelis who are Jewish, Moslem and Christian, and who identify as Arab, Druze, Ethiopian, Palestinian and several other ethnicities. It was this recognition that motivated me to start to photograph all of the different types of people in the land of Israel. These images have allowed me to create "Faces of the Holy Land," an in depth look at Israel's diverse population, culture and community.

First Exposure to Israel

I am a graduate of the Beth Tfiloh Dahan High School in Baltimore, and I was brought up with a sense of how special the land of Israel is to the Jewish people. Despite all the threats, the State of Israel has existed now for more than 50 years. Throughout my education, I was taught about the Jewish people's struggles to re-establish a Jewish state. I identify with my people and with that struggle, and I hope one day to make Israel my home. My interest in photography developed during my high school career. During that time, I went nowhere without my camera. This, of course, included my senior class's trip to Poland and Israel. Seeing the devastation in Poland only reinforced my thankfulness that the State of Israel does indeed exist.

Influence of Further Education

Prior to the beginning of my college career, I chose to spend a year studying in a yeshiva (an academy of Jewish learning). I decided early on that I wanted to learn in an Israeli environment rather than in an American program. For this reason, I chose to study at Yeshivat HaKibbutz Hadaati in Kibbutz Ein Tzurim, which sits in the southern part of Israel near the town of Ashkelon. For the first time, I was completely

immersed in Israeli life. As the only American in the yeshiva, learning Hebrew and making Israeli friends were musts. It was during my first months there that I began to experience the diverseness of the land of Israel directly.

Creation of an Exhibit

After returning to the United States, I spent much of my free time during the next year enlarging some of my photographs taken in Israel. It was not until I looked at several of the images next to one another that I realized that the photographs before me conveyed a very important message. Although Israel might appear limited on a map, it is actually quite a large place. I returned to Israel the following summer to take more photographs. I again walked the streets of Jerusalem, Tel-Aviv, Haifa and several cities in the Northern part of the country, photographing the many people who caught my interest.

Ultimate Goal

As a teacher, it is my goal to teach Jewish students the importance of the State of Israel and of Zionist beliefs and values. As a photographer, I can best augment my teaching with photographs. Hopefully, soon anyone who wants to will be able to live in the land of Israel and be one of the "Faces of the Holy Land." Until then, however, it is my goal to help to make all Jews understand the importance of Israel and what it has to offer.

IMDA Undergraduate Web Gallery

yourideahere.umbc.edu

Kelissa Kesler, Jason Lubawski, David Rojas, Joanna Sakellion, Daren Thompson and Allison Tirdil

Advisor: Professor Lisa Hutton

Visit the site to see areas exhibiting faux documentaries, the intertextual network, hypertext artwork, explorations of the future and interface attractions.

Imaging and Digital Arts

Class Interactive Project

Chrimson Barocca, Timothy Brown, In Choi, Ryan Craun, Sean Filburn, Rebecca Flanders, Jenae Gates, Adam Goode, Bridget Hanlon, Jason Jones, Trevor McCauly, Chris McGinness, Justin Marksamer, Steve Perrie, Hilda Schulke, My-Lin Thatch and Daren Thompson

Advisor: Professor Lisa Hutton

These projects are from ART 382 Intermediate Interactivity. Students are asked to create a button-based musical instrument, a computer game with a socially relevant message and a final of their choosing; this in addition to two other projects where students use Director as a text-only (typography only) animation tool and as an animation tool that can use a soundtrack to enhance the content of a text-based animation.

Imaging and Digital Arts

The Virtual Mime

Dennis Moellers

Advisor: Professor Dan Bailey

The objective of this research project is to create a three-dimensional computer animation that comments on the creation and use of space and objects in a virtual world. This short movie features a classic mime that reacts to invisible but solid objects that he constructs visually for his audience such as walls, chairs and ropes. Simultaneously, the three-dimensional virtual world will construct these objects, as they become an actual part of the environment for the film's audience. This situation will demonstrate to the viewer that three-dimensional computer art is not just the recreation of the natural world, but a virtual world of its own.

Natural world simulation in computer animation has been increasing steadily since its establishment. Three-dimensional computer simulations can easily create collisions, gravity and friction according to the user's input. Recently, there has been predominance in the field of computer animation to mimic the natural world accurately, as opposed to exaggerating or distorting it. This excessive use has steered many animators away from creativity and toward a duplication of the natural world. In this film, a virtual mime's physical interaction with his own imaginary world is used to comment on this predicament. As the mime's three-dimensional environment was created, objects he reacted with were produced as actual objects in virtual space. This allows the character to navigate around the objects as if the objects are really there.

Before rendering the animation, the obstacles were hidden from sight, and only the mime and background were visible. In this virtual environment, he is able to complete physically impossible tasks such as setting all of his weight on the obstacles in sitting or standing positions. A mime in the natural world simply acts as if he comes into contact with obstacles. However, the virtual mime really exists in his imagined virtual world. This is just one example of the possibilities of working in a virtual environment not held down by real-world physics. It is anticipated that the audience will recognize this as a world in itself and not simply as a recreation of the natural world. Hopefully, this will influence the digital community to focus on creativity instead of imitation.



The Virtual Mime