

*Fostering a Community of Student Scholars in the Arts, Sciences,
Social Sciences, Technology, and Humanities*

UNIVERSITY OF WASHINGTON'S
Fifth Annual Undergraduate Research Symposium
A Celebration of Undergraduates in Research

17 May 2002
MARY GATES HALL
12:00 – 5:00 PM

PROCEEDINGS

*Sponsors: The Office of the President, Office of the Provost, Office of Research,
and Office of Undergraduate Education*

DEDICATION

To the faculty and staff, who through generosity and passion invite undergraduates to participate in the knowledge-making enterprise, and to the students who so eagerly take up that challenge.

UNIVERSITY OF WASHINGTON'S
FIFTH ANNUAL UNDERGRADUATE RESEARCH SYMPOSIUM
PROCEEDINGS

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PLEASE NOTE

Throughout the proceedings, abstract authors are listed as follows:

STUDENT AUTHORS(S), Major, Class-standing
FACULTY MENTOR(S), Department

The Fifth Annual Undergraduate Research Symposium is organized by the Undergraduate Research Program (URP), which facilitates research experiences for undergraduates in all academic disciplines. URP staff assist students in planning for an undergraduate research experience, identifying faculty mentors, projects, and departmental resources, defining research goals, presenting and publishing research findings, obtaining academic credit, and seeking funding for their research. Students interested in becoming involved in research may contact the URP office in the Undergraduate Gateway Center in Mary Gates Hall for an appointment or send email to urp@u.washington.edu. URP maintains a listing of currently available research projects and other resources for students and faculty at: www.washington.edu/research/urp.

*Janice DeCosmo, Director
Jessica Beyer, Nichole Fazio, Coordinators*

POSTER SESSION

“Research has brought the unknowns and intricacies of science to life. Science has become not just a textbook of information to memorize, but an ongoing search for understanding. Research has taught me to respect and love the process of science, not just the results.”

-Junior, Biochemistry

“My research experience has been a very valuable part of my education, as much as any class I have taken. It is one thing to read about facts in a class setting;

it's another to try and discover them for yourself.”

- Junior, Political Science

POSTER SESSION

TELOMERE LENGTH VARIATIONS AND CHROMOSOME FUSIONS IN HUMAN TUMOR CELLS

ERINN ALDEN, Biochemistry, Senior
JEFFREY SCHWARTZ, Radiation Oncology

The induction of genomic instability is believed to be an important early event in carcinogenesis. Most tumors show some degree of instability and one of the major markers of which is the presence of dicentric chromosomes caused by fusions of telomeres. One goal of this study is to determine the dependence of cell stability on telomere metabolism and function. In addition, because the human gene p53 seems to be an important factor in the maintenance of genome stability, we are examining the relationship between p53 status and chromosome instability. The cancer cell lines being investigated are A549 and HT29. The former has p53, while the latter is deficient in p53. Both have been transfected with a plasmid called pSXPneoD which integrates adjacent to the chromosome 7q telomeres. This plasmid tag allows us to monitor 7q telomere length by Southern analysis. Our goal is to monitor length over time and correlate changes in length with chromosome fusions at 7q. Preliminary results in clones isolated from each line suggest that the plasmid has integrated properly into chromosome 7. We plan to isolate clones with different chromosome 7q telomere lengths and determine whether chromosome 7 fusion frequencies are linked to telomere length.

BUSINESS, LAW, AND THE ENVIRONMENT, AND THEIR INTERACTION AND SIGNIFICANCE IN THE BUSINESS REALM

DONNA ANDERSON, Business Administration, Senior
MIKE GIAMBATTISTA, International Business
FARROKH SAFAVI, Marketing

Corporate America is not adequately addressing business's responsibility for protection of the physical environment. My research will focus on the cost to the public as well as to corporate profits and what can be done with Risk and Quality Management to ensure that both public health and corporate profits are protected. This project encompasses three disciplines: law, environment and business. The project addresses an unlicensed hazardous waste dumpsite near Bellingham, Washington in Whatcom County. Initial toxicology research has shown that corporations involved in dumping of HAZMAT listed byproducts significantly affect the health of citizens in our community and that this has been an ongoing practice by a segment of corporate America. My research will show how intertwined the toxicology, litigation and business profits can be and will result in recommendations for corporations operating in the new millennium. This project will be of value to the community, academia, and corporate America.

CHARACTERIZATION OF CD4+ AND CD8+ T CELL RESPONSES TO HERPES SIMPLEX VIRUS USING THE INTERFERON-GAMMA ELISPOT ASSAY

KRISTIN ANDERSON, Cellular and Molecular Biology and Neurobiology, Senior
CHRISTINE POSAVAD, Laboratory Medicine

Herpes simplex virus type 2 (HSV-2) causes genital herpes, a sexually transmitted disease affecting 1 in 5 adults in the US. After initial infection, HSV-2 remains latent in neural cells with frequent clinical and subclinical reactivations. Cellular immunity to HSV-2 most closely correlates with control and clearance of HSV-2 reactivations. Presentation of HSV-2 antigens to T cells elicits an antiviral response including the production of the cytokine interferon-gamma (IFN-g). To determine which HSV-2 antigens are recognized by T cells we have developed

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an IFN-g Elispot assay to measure CD4+ and CD8+ T cell responses to several individual viral proteins or peptides. The Elispot assay is a quantitative assay that is more sensitive and reproducible than standard cytotoxic assays. CD8+ and CD4+ T cells were isolated from peripheral blood mononuclear cells (PBMC) from HSV-2 seropositive persons. To analyze CD8+ T cell responses, we used a panel of recombinant vaccinia viruses encoding individual HSV-2 genes including ICP27, ICP4, ICP0, and gD-2 as well as an HLA-A2-restricted epitope in UL47. CD4+ T cell responses were analyzed using purified HSV-2 proteins gB-2, gD-2, VP16. Interestingly, five of six HSV-2 infected subjects tested had CD8+ T cell responses to ICP27. We are currently determining the epitope(s) recognized by these ICP27-specific CD8+ T cells using overlapping peptides. An HLA-A2 restricted CD8+ T cell epitope within UL47 was recognized by CD8+ T cells from 5 of 7 HSV-2 infected HLA-A2+ subjects. CD4+ T cells were tested in four HSV-2 infected subjects. All four subjects possessed CD4+ T cells that responded to whole HSV-2 antigen. gD-2 was recognized by two of the subjects and gB-2 and VP16 were each recognized by 1 subject: one subject recognized all three proteins, one subject recognized only gD-2 and two subjects did not respond to either of the three proteins. These data suggest that Elispot is a useful assay to detect the presence of CD4+ and CD8+ T cells to whole virus or individual viral proteins. Our ultimate goal is to determine which viral antigens are important for control of HSV infection to rationally design therapeutic and prophylactic vaccines to HSV-2.

REDESIGN OF GLASS-CAPILLARY HANDLING SUBSYSTEMS FOR ZERO DETECTABLE OPERATOR INTERVENTION FAULTS IN THE ACAPELLA 5K FLUID SAMPLE HANDLING SYSTEM

The A5K is a sophisticated biomechatronic robot that has numerous computer controlled subsystems that was developed in the Genomation Laboratory under the direction of Prof. Deirdre R. Meldrum. Stringent specification have

TIFFANY ANDERSON, Pre-Engineering, Freshman
SARAH AKERS, Pre-Engineering, Freshman
VICTORIA LOCKHART, Pre-Engineering, Freshman
BRYAN MUNRO, Pre-Engineering, Freshman
SPACE GRANT SCHOLAR

HANNAH YAU, Pre-Engineering, Freshman
DANYELLE THOMAS, Pre-Engineering, Freshman
JESSIE SHULMAN, Pre-Major, Freshman
MARK HOLL, *Electrical Engineering*

been set for overall A5K system performance (no more than 3 operator interventions during an 8 hour, 5000 capillary run). One A5K subsystem has been characterized to generate between 3-4 operator intervention faults in a 5000 capillary run, the capillary delivery system and hopper subsystem. We have investigated these failure modes and have worked to develop concepts to improve system performance. As part of this capillary delivery subsystem redesign we have developed design concepts for: 1) a design for a dedicated test bed for next generation capillary hopper and capillary loading validation testing, 2) new sensor configurations to determine if good capillaries are present for loading, and 3) a detailed conceptual design for the automated loading of 25 disposable plastic hoppers with 5000 good capillaries each in one 8 hour day.

POSTER SESSION

AN ANALYSIS OF OPEN-ENDED QUESTIONS IN THE WASHINGTON STATE ASSESSMENT OF STUDENT LEARNING (WASL)

ONA ANICELLO, Psychology, Senior, MCNAIR SCHOLAR, PRESIDENTIAL SCHOLAR
MIRIAM BASSOK, *Psychology*

In recent years, open-ended questions have become widely implemented in standardized tests involving mathematics. The hope is that the inclusion of such questions would lead to changes in the curriculum and in the design of course lessons that would enhance students' understanding of and communication about mathematics. However, due to the cost of implementing open-ended questions, there is a debate as to whether open-ended questions should remain part of mathematics standardized testing. The present study investigates what can be learned from students' responses to open-ended questions beyond the correctness of their answers. Thirty-two, tenth grade students' responses to four open-ended questions from the Washington State Assessment of Student Learning (WASL) were analyzed. Three main categories were developed to characterize the quality of students' explanations to open-ended questions. We intend to examine whether and how explanation quality correlates with the mathematical correctness of the responses.

UNDERSTANDING LYMPHOPENIA THROUGH BLOOD GLUCOSE, WEIGHT AND TYPE 1 DIABETES

KEERTHI ARANI, Pre-Major, Sophomore
AKE LERNMARK, *Medicine*
JESSICA FULLER, *Medicine*
PHIL YEN, *Medicine*

To develop effective strategies to avert and treat insulin-dependent diabetes mellitus (IDDM), it is necessary to identify and characterize specific factors involved in the disease process and to study additive effects that may cause the advancement toward clinical onset of diabetes. Genetic factors, although important, are insufficient by themselves to determine advancement. Instead, interactions between genetic susceptibility factors, environment and the immune system seem crucial. In human diabetes, the goal of finding the relationship between immune system function and diabetes has been difficult to pursue because of a lack of knowledge in the development of human autoimmune diseases, lacking human pancreatic islet tissue (where insulin is produced) to study the liver as well as complicated inheritance patterns. Animals that develop diabetes are thus convenient to study to understand the factors, genetic and environmental, which control IDDM development. In particular, the BioBreeding rat ("BB rat") presents a unique opportunity to examine genetic factors linked to the development of IDDM. BB rats develop a spontaneous disease closely resembling human diabetes in which they experience similar symptoms like weight loss, polyuria (excessive urination), polydipsia (excessive thirst), and ketoacidosis (results from severe insulin deficiency). The data collected will help determine the relationship between body weight, age and onset of diabetes in the hopes of ultimately both mapping and determining the role of the lymphopenia region of the BB rat. Lymphopenia (a type of extreme T-cell deficiency), which is common in the diabetes prone BB rat at birth, is not found among humans with the disease. The gene responsible for lymphopenia appears to singularly control normal maturation of thymocytes. Lymphopenia gives an otherwise diabetes resistant BB rat an almost 100% probability of developing IDDM. Study of this gene will add to the understanding of the role that immune system function plays in the clinical onset of diabetes.

POSTER SESSION

INCIDENCE OF VIRAL HEMORRHAGIC SEPTICEMIA VIRUS (VHSV) AND ERYTHROCYTIC NECROSIS VIRUS (ENV) AMONG CAPTIVE JUVENILE PACIFIC HERRING *CLUPEA PALLASI* IN PUGET SOUND, WASHINGTON

YUZO ARIMA, Biology, Senior
RICHARD KOCAN, *Aquatic and Fishery Sciences*
PAUL HERSHBERGER, *Aquatic and Fishery Sciences*

Viral erythrocytic necrosis (VEN) and viral hemorrhagic septicemia (VHS) are two viral diseases that affect Pacific herring *Clupea pallasii*, a species of economic and ecological importance in the Pacific Northwest. Although the epizootiologies of VEN and VHS have been described, the concomitant kinetics of both diseases in a single population are poorly understood. The current study monitored wild-caught juvenile Pacific herring for both diseases under laboratory conditions, and we conclusively demonstrated that wild juvenile Pacific herring may simultaneously be infected with ENV and VHSV. Microscopic examination of blood smears revealed a high prevalence of ENV, as evidenced by the presence of erythrocytic inclusion bodies characteristic of VEN in 100% of the fish examined. The level of infection, measured by the mean percent of infected erythrocytes, increased from 8% to 48% during the first 15 days of captivity, but decreased to 36% by 28 days post-confinement, suggesting some recovery from infection during confinement. On the contrary, the prevalence and level of VHSV remained low during the entire 28 day monitoring period. On the basis of testing whole body homogenates by cell culture on epithelioma papulosum cyprini (EPC) cells, only 3% of all the fish sampled tested positive for VHSV, and among the positive fish infection levels were very low. In contrast to ENV, the data suggest that the fish may have developed resistance to VHSV prior to confinement.

A NEW TEXTBOOK OF PERSIAN LANGUAGE AND GRAMMAR

MANDANA ARIMAND, International Studies, Sophomore
AHMAD KARIMI-HAKKAK, *Near Eastern Languages and Literature*

My project was to research and develop resources for the presentation and integration of the Persian language, grammar, and culture for beginning students. The lesson-by-lesson "textbook" includes exercises, illustrated by several major "characters" that appear throughout the book. This textbook for beginning Persian, was developed through research of other primary grammar sources, such as Ann K. Lambton's *Persian Grammar*. Accompanying these exercises are history lessons, which include pictures, links, maps, and other illustrations. We have also developed a class website where students will be able to view coursework online and do interactive grammar exercises. The lessons are based on Hakkah's original designs and were further developed and tested with students for this project.

POSTER SESSION

BOOTS

KATHLEEN ASMANN, Art, Senior
CURT LABITZKE, Printmaking
SHIRLEY SCHEIER, Printmaking

Printmaking is my chosen method of producing art because it most directly transcribes my drawings into cohesive visual concepts. Drawing allows me to interpret what I see in contemporary culture. Printmaking enables me to reproduce these interpretations. Historically, the medium of printmaking including woodblock cuts, etchings, lithographs and screen prints, has been used to reproduce one specific image or idea in great numbers. Printmaking considers equally the content of the reproduced image as well as technical aspects encountered throughout the process. With printmaking I feel that the process of producing a print sometimes becomes the actual art. The end product becomes something that others react to while the act of creating art is my reaction to the possibilities and equations of images within a composition. My visual source material originates mainly in mass media, specifically magazines but also includes the spaces I live and work in. I feel that magazines provide interesting and controversial imagery that parallels pre-conceived stereo types that have been generated by our society. My interests lay more specifically in social and gender constraints and assumptions as well as possibilities created by excessiveness. Observation, reading and drawing are the essential elements that lead me to formulate and identify concepts. The situations I create are a reaction to the information, imagery, and sources from which I collect. These situations become my comment of the overly sensitive social issues that our society has created and by which I find myself entertained and amused. The reaction of the audience toward the content of my work combined with an appreciation for a careful consideration of the process I have found leads to an uncomfortable combination. When the content of a familiar context changes often the opposite reaction catalyzes in the audience when they must admit their relation.

EXPLORING FUNCTIONAL REDUNDANCY IN THE ARABIDOPSIS ERECTA RECEPTOR-LIKE KINASE SIGNALING PATHWAY: EXPRESSION AND FUNCTION OF TWO ARABIDOPSIS ERECTA-LIKE GENES

CHRIS BERTHIAUME, Cellular and Molecular Biology, Senior
KEIKO U. TORII, Botany

Higher plants possess a large number of putative receptor kinases (RLKs) that display structural similarity to animal growth factor receptor kinases. However, the exact roles of RLKs in plant development remain largely unknown, with a few exceptions. The *Arabidopsis ERECTA* gene encodes an RLK with an extracellular leucine-rich repeat domain. Analyses of loss-of-function *Erecta* mutants suggest that *ERECTA* regulates cell proliferation during organ growth. At present, the intricacies of the *ERECTA* signaling pathway are not very well understood. We have isolated two *ERECTA-LIKE* genes, *ERL1* and *ERL2*, that possess gene structure identical to *ERECTA*. The predicted *ERL1* and *ERL2* proteins share a high degree of sequence identity to *ERECTA*. Both *ERL1* and *ERL2* display partially overlapping expression patterns with *ERECTA*, indicating possible functional redundancy. We did a knockin of the coding regions of *ERL1* and *ERL2* into *erecta* knockout plants under the control of the *ERECTA* promoter and terminator. Both *ERL1* and *ERL2* rescued internodal elongation defects of *Erecta*, indicating that these *ERLs* are functional complements of *ERECTA* and that they are capable of perceiving and transducing the same signals as *ERECTA*. To gain insight into the roles of *ERLs* in *Arabidopsis* development, we isolated T-DNA insertion knockdown and knockout alleles for both *ERL1* and *ERL2*. Our preliminary phenotypic analysis suggests that a single loss-of-function mutation in either *ERL1* or *ERL2* locus does not lead to the severe developmental defects. We are currently generating double and triple knockout mutants of *Erl1*, *Erl2*, and *Erecta* to elucidate potential functional redundancy among these genes. Such analysis may also suggest a phenotype for loss-of-function of the *ERECTA* ligand, aiding its discovery.

POSTER SESSION

CHARACTERIZATION OF THE NATURALLY PROCESSED MYELIN BASIC PROTEIN EPITOPES

NENA BONN, Biochemistry, Junior, MARY GATES SCHOLAR
EMILY BAIRD, Biochemistry, Senior, MARY GATES SCHOLAR
CRAIG BEESON, Chemistry

Experimental Allergic Encephalomyelitis (EAE), the murine model for multiple sclerosis, allows the study of autoimmune diseases. One of the autoantigens in EAE is Myelin Basic Protein (MBP), a protein involved in the stabilization of the myelin sheath. The presence of auto-reactive TH1 cells specific for MBP indicates a tolerization failure for this self-protein. It is hypothesized that certain MBP peptides are not present in the thymus and are therefore unavailable for tolerance induction. In the thymus, self-peptides are presented by Class II Major Histocompatibility Complex (MHC) proteins. Although many MBP peptides could bind to MHC proteins, only certain epitopes are naturally processed, the epitopes containing residues 1-18 and 122-138. We hypothesize that if the affinity of a naturally processed MBP peptide for MHC protein is weak, the complex will dissociate quickly, producing an insufficient level of antigen to induce tolerization. Thus, auto-reactive T-cells specific for these epitopes would escape the thymus. To evaluate this hypothesis, the binding kinetics of the naturally processed epitopes of MBP bound to MHC were determined. Peptides were chemically synthesized and labeled with fluorescein. The labeled peptides were bound to MHC, and the dissociation rates were determined through size-exclusion chromatography. From dissociation studies, it was found that the MBP 122-138 peptides form very stable complexes with MHC protein, displaying dissociation half-times of about 200 hours. Studies showed that T-cells that recognize these peptides are deleted in the thymus. Although it was known that the MBP 1-11 peptide dissociates rapidly, it was found that MBP 1-18 does not. The 1-18 peptide, however, contains a second register, 5-17, that binds stably to MHC protein. The 1-18 peptide binds predominantly in the 5-17 register and not in the 1-11 register. Thus, T-cells that can recognize the 1-11 register escape the thymus and can then mediate disease.

TRILLING TRILBY

LARA ELAINE BONOW, Pre-Major, Freshman
DICK DUNN, English

In the novel *Trilby* by George Du Maurier are many references to the popular music of 1850. My project is to build a web site of all of the music mentioned in the book and create links to the MIDI files of the music. I have also created links to the composers of this music. This web site www.belltunes.com/Trilby.htm explores how listening to the music of this era can evoke the spirit of the times and how one can better understand the mind of the writer, George Du Maurier, and the forces behind his creativity. The best way to fully appreciate the underlying meaning of *Trilby* is to listen to the music which is an integral part of the drama.

OPTIMAL FORAGING IN REMOTE ISLAND ENVIRONMENTS: ARCHAEOLOGICAL FISH REMAINS FROM FAR EASTERN RUSSIA

CRISTIE BOONE, Anthropology, Senior
BEN FITZHUGH, Anthropology

Archaeologists have studied human adaptations to island environments for many years, but most of this research has focused on human settlements that already depend on agriculture for subsistence. The Kurils, a chain of volcanic islands in far eastern Russia, were utilized prehistorically by groups of maritime hunter-gatherers, and are therefore an ideal place to research hunter-gatherer exploitation of remote island environments. In the year 2000, the International Kuril Island Project surveyed and tested the Kuril Islands and Sakhalin for archaeological sites.

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My research project compares fish remains from two of the Kuril Islands and Sakhalin, which is a large island just off of mainland Russia. Hunter-gatherer exploitation of fish resources should vary depending on an island's size and distance from the mainland. The theory of island biogeography tells us that there will be different resources available on remote islands, and this is certainly evidenced by the modern-day Kurils, where terrestrial mammals are small and few. Sakhalin, on the other hand, has a variety of large, high-return terrestrial mammals. Optimal foraging theory suggests that hunter-gatherers in the Kurils would need to depend on a greater variety of other resources in order to balance out the lack of high-return terrestrial mammals. As a result, hunter-gatherers should have depended more on fish and used a wider variety of fish in the Kurils than on Sakhalin. Results from this project should help explain the adaptations of hunter-gatherers to isolated island environments.

VISUALIZATION OF RISE IN TEMPERATURE BY HIGH INTENSITY FOCUSED ULTRA SOUND IN TISSUE

JASON BUSH, Chemical Engineering, Junior
MICHAEL BAILEY, Applied Physics

High intensity focused ultrasound (HIFU) creates a focused sound field with the highest pressures in a 2mm x 10mm cigar shaped region (with our transducer). Significant heating (over 30 degrees Celsius) occurs primarily within the concentrated region where the sound pressures are highest. This means surrounding tissue can be spared from injury. However the exact heating patterns are not known. For example the HIFU can form bubbles with heating and increase the attenuation by more than a factor of 2 preferentially. The goal of this study is to make a map of the temperature field in the tissue created by HIFU and to simultaneously measure the acoustic attenuation. Our transducer was bowl-shaped, running at 2 MHz, with a single element. We used an acoustic power of 27 and 54 watts. For our experiment the transducer was mounted on a box. The temperature measurements were made with an infrared camera. Since the camera could only take pictures at surfaces, we stacked two slabs of liver in a box, such that their interface was along the axis of the transducer. The attenuation data ranged from the x-y, which fit well with the range in the literature and with the lowest value being for degassed liver. The thermos camera and attenuation data will be used to calibrate a numerical code designed to predict the temperature field in the liver. Our combined results will then be used to predict effective treatment dosages and guide HIFU treatments.

GLOBAL SCREEN FOR GENES INVOLVED IN KARMELLAE BIOGENESIS

EMILY CADERA, Biology, Senior
CHRIS TACHIBANA, Genetics
ROBIN WRIGHT, Zoology
JENNY LOERTSCJER, Zoology
JEFF SHAVER, Zoology

In the yeast *Saccharomyces cerevisiae*, high levels of the sterol biosynthetic enzyme HMG CoA reductase cause the endoplasmic reticulum to proliferate and form karmellae, stacks of paired smooth ER membranes that are closely associated with the nucleus. The Wright lab studies this cellular differentiation from a variety of perspectives, including identification of genes involved in karmellae biogenesis and analysis of the effects of karmellae on cellular structure and function. The expectation is that understanding the molecular basis of karmellae assembly will provide insights into the mechanisms by which cells regulate organelle number, size, and morphology. A project currently underway in the Wright lab is a large scale screen of homozygous deletion mutants in the *Saccharomyces cerevisiae* genome to identify nonessential genes involved in karmellae biogenesis. Approximately 5000 strains, each lacking one nonessential gene, were transformed with a plasmid that induces karmellae biogenesis by producing high levels of HMG CoA reductase. Slow growth of a deletion strain under karmellae inducing conditions indicated that the deleted gene may be required for directing or modulating karmellae biogenesis. Approximately

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5000 strains, each lacking one nonessential gene, were transformed with a plasmid that induces karmellae biogenesis by producing high levels of HMG CoA reductase. Slow growth of a deletion strain under karmellae inducing conditions, indicated that the deleted gene may be required for directing or modulating karmellae biogenesis. About 800 deletion strains were identified as growing slowly under karmellae inducing conditions and were next put through a second more selective screen. Around 100 strains showed a significant growth rate decrease under karmellae inducing conditions in this screen. The identified genes were grouped by function and strains of interest are currently ready for further in-depth analysis.

THE EFFECTS OF EMOTIONAL NUMBING ON MEMORY

AMANDA CARLSON, Psychology, Senior

LORI ZOELLNER, Psychology

Research on post-traumatic stress disorder (PTSD) suggests that the inability to experience and express emotions of any kind, and the disinterest in activities following a trauma may distinguish between individuals with and without PTSD (Foa et al., 1995). The presence of such symptoms, called emotional numbing, has also been found to be predictive of the development of later PTSD (Foa et al., 1995). Cognitive schema models of individuals with PTSD suggest that their fear networks involve excessive response elements such as avoidance, escape, and psychological activity that are not represented in reality and that emotional numbing may interfere with the access of these fear networks, hindering natural healing (Foa & Jaycox, 1999). This study examines the role of emotional numbing on memory functioning. The study was of mixed design 3(group: PTSD, trauma exposed non-PTSD, non-trauma exposed control) x 2(video: neutral/threat segments) x 2(mood manipulation: inhibitive/emotionally expressive) with group as a between subject variable and video and mood manipulation as within subject variables. Participants viewed video segments followed by a cued recall task for both central and peripheral details. When asked to inhibit for both the threat and neutral scenes, participants with PTSD displayed a worse recall of both central and peripheral details compared to those without PTSD. These results will be discussed in light of possible effects of emotional numbing impairing emotional processing of the trauma memory and leading to the maintenance of PTSD.

EXCLUSION OF SMALL PARTICLES BY MUSCLE TISSUE AND PROTEIN GELS IN MUSCLE RELAXING SOLUTION

CHRIS CARRICO, Bioengineering and Biochemistry, Senior, MARY GATES SCHOLAR

GERALD POLLACK, Bioengineering

The exclusion of small, slightly charged spherical objects 1 μm in diameter from the vicinity of muscle tissue was observed last September in muscle relaxing solution. Subsequent observations of rabbit skeletal muscle and actin gels in relaxing solution with small plastic microspheres of various charges have confirmed this result, with a zone of low or zero concentration consistently exhibited and recorded using a video camera and optical phase-contrast microscopy. Our project seeks to quantify and explain these puzzling results, and examine the quantitative and qualitative effects of various environmental conditions on the exclusion phenomenon. Possible implications of these experiments include the use of protein's exclusory properties for medical applications, and engineered protein gel applications in fields of biology and medicine. As the experiments are comparatively basic, it stands to reason that applications of these results will be general rather than limited to any specific use.

POSTER SESSION

EXAMINING THE RELATIONSHIP BETWEEN NEGATIVE COGNITIVE APPRAISAL AND DEPRESSION AMONG MALTREATED CHILDREN

GENEVIEVE CARUNCHO, Social Welfare and Psychology, Junior
TODD HERRENKOHL, *Social Work*
EMIKO TAJIMA, *Social Work*

Research has shown that children who have been maltreated are at an increased risk of participating in behaviors during adolescence that may be harmful to themselves and/or others. The objective of this project is to examine the effects of negative cognitive appraisals as a mediator for later depression. To examine this, the project uses the Lehigh Longitudinal Study dataset to examine the relationship between early emotional abuse, negative cognitive appraisals, and later depression. The Lehigh Longitudinal Study is a prospective study of children and families that began in the 1970s. This study collected data from several sources at three developmental stages: preschool, school age, and adolescence. Our hypothesis is that negative cognitive appraisal will increase the chances that the individual will later develop depression. Results from this study should not only raise awareness about the developmental impact of child maltreatment but also increase knowledge about the interventions that are necessary in assisting maltreated children in leading healthy and productive lives.

KNOWLEDGE AND FEARS CONCERNING THE PAPANICOLAOU TEST AND CERVICAL CANCER

MIRIAM CASTRO, Biology and Latin-American Studies, Senior
VIRGINIA GONZALES, *Center for Health Education and Research*
MICHELLE WILLIAMS, *Epidemiology*

This study examines the levels of Papanicolaou utilization and the levels of knowledge, fear or anxiety related to the Papanicolaou test and cervical cancer in a population of low socioeconomic status women in Motupe, Peru. A simple random sample of all households within the community was conducted. A survey was administered to 300 women between the ages of 18-50 years. Results include the following: (1) Good overall Pap and cervical cancer knowledge was related to higher levels of education, having more pregnancies, and having more Paps. (2) An increase in fear and anxiety levels with regard to the Pap was associated with decreased Pap and cervical cancer knowledge. (3) A large proportion of women, 43%, reported fear associated with having a Pap test conducted at their local health establishment. (4) Though most women, 77%, cited a health establishment as their primary source for Pap and cervical cancer information, only 48% of women reported accurate knowledge regarding the purpose of the Pap test. We conclude that a community-based intervention program should target women exhibiting the lowest utilization patterns and who are in the lower educational strata. *Promotoras*, lay health educators, would serve as key catalysts to such programs because of their accessibility to those who under-utilize women's health services.

POSTER SESSION

SPECTROSCOPIC STUDIES ON METAL DERIVATIVES OF PORPHYRINS AND PORPHOLACTONE [A NEW PORPHYRIN RING]

ALVIN CHANG, Chemistry, Senior

GAMAL KHALIL, Chemistry

Pressure Sensing Paint (PSP) was developed using Platinum meso-Tetra (pentafluorophenyl) Porphine (PtTFPP) by applying the oxygen quenching activity of the metal porphine. Since this PSP is not temperature independent, a better PSP needs to be developed. Using absorption and emission spectrometry, a number of compounds, (H₂TFPL, MgTFPL, NiTFPL, PdTFPL, PtTFPL, H₂TFPP, MgTFPP, ZnTFPP, YTFPP, PdTFPP, PtTFPP, and GdTFPP), were investigated. By analyzing the absorption, fluorescence and phosphorescence emission spectra, a collection of physical characteristics such as absorption coefficient, phosphorescence emission wavelengths, relative quantum yields, and lifetimes of the compounds were obtained.

A COMPARATIVE STUDY OF GROWTH AND NUTRITIONAL STATUS AMONG CHILDREN WHO WORK AND CHILDREN WHO DO NOT WORK, PEDRO MONCAYO COUNTY, PICHINCHA PROVINCE

LORENA CHAVEZ, Psychology, Junior

MICHELLE WILLIAMS, Epidemiology

Pedro Moncayo County (PMC) has been ranked one of the poorest counties in Ecuador and increasingly residents of PMC have pressed their younger members into the workforce. In 1990, the national Ecuadorian census registered 482,459 workers between the ages of 8 and 19 years. The purpose of our study was to assess the extent to which child labor, family household income, and educational level for the head of household influenced the nutritional status among these children. Data were collected using a survey with 473 randomly selected families. Of the 1,120 children surveyed, 72.7% had a body mass index (BMI) that was below the American Institute for Cancer Research standard. Infants were disproportionately (48.9%) diagnosed as suffering from growth retardation. Approximately 17% of them were found to be chronically malnourished; and 1.3% of infants were found to have acute malnutrition. Importantly, 5.0% of infants were found to have global malnutrition, defined as having a body weight that is at least 3 standard deviations below the population mean. In PMC, 64.7% of the population has a low socioeconomic index. Out of the children living in the homes of heads of household who reported having no educational instruction, 86.8% were under-grown. A majority of children who worked (69.6%) were found to have sub-optimal growth. Although the Ecuadorian legal limit of 30 hours of labor per week is specified, we found that in PMC, 21% of the children worked considerably over that limit. Our study indicated that the majority of the children 0 to 15 years of age in PMC are malnourished; and that socioeconomic status and educational level of the head of household are determinants of child nutritional status. Due to some limitations we could not accurately determine the effect of child labor on their nutritional status. Immediate action and improvement of public health programs are needed to offset the high prevalence of child labor and malnutrition in PMC, Ecuador.

POSTER SESSION

ANALYSIS OF STRUCTURE DETERMINANTS IN NC-RNA COMPLEX BY ISOLATING SECOND SITE SUPPRESSORS OF A PACKAGING DEFECTIVE MUTANT

AMOS CHEN, Microbiology, Senior

MAXINE LINIAL, Microbiology

EUN-GYUNG LEE, Basic Science, Fred Hutchinson Cancer Research Center

In the retroviral assembly, retroviruses incorporate two copies of genomic RNA into viral particles. A cis-acting sequence in genomic RNA is specifically recognized and bound to the viral Gag polyprotein, which allows efficient encapsidation. The Gag protein of avian sarcoma leukosis virus (ASLV) consists of matrix (MA), p2, p10, capsid (CA), nucleocapsid (NC), and protease (PR). With the use of ASLV, our lab and other groups have found that the NC domain of Gag confers the specificity of RNA encapsidation; however, the relationship between the structure and function of NC for RNA packaging is not fully understood. The yeast three-hybrid system has been developed to study avian retroviral packaging RNA-Gag protein interactions by measuring transcriptional activities of the reporter gene *lacZ*. The amount of b-gal activity from *lacZ* is found to be positively correlated to the packaging efficiency measured in an *in vivo* packaging assay. With this technique, we discovered that the mutation of RKR to RTL downstream of the distal Cys-His box of NC did not affect its binding and packaging activity; however, RKR to SKL did, suggesting that only the first positive residue is essential. To further understand the structure-function relationship of NC protein, second-site suppressors that are able to restore the binding activity of NC-SKL are being studied. By using random mutagenesis of NC-SKL sequences and the use of yeast three-hybrid binding assay, suppressors are selected. Three NC-SKL mutant suppressors with a single-base change in p10 or CA have been found, and are being characterized for effects on packaging in a viral packaging assay. New constructs containing the secondary mutations without the SKL mutation will also be made and studied for binding and packaging activities using the yeast three-hybrid system and the viral packaging assay.

THE EFFECTS OF MATERNAL STRESS ON LEARNING ABILITY IN JAPANESE QUAIL

SARAH CHILDERS, Women Studies and Political Science, Senior

JOHN WINGFIELD, Zoology

LISA HAYWARD, Zoology

Stress experienced in pregnant mammals has profound effects on many aspects of offspring development, including learning ability. However, very little is known about the effects of stress experienced by a laying bird on her offspring's development. Work in the 1990s has shown that maternal sex steroids are deposited in egg yolk, and significantly affect offspring fitness. As stress steroids are similar in structure to sex steroids we theorized that they would also be deposited in the yolk. Preliminary results show this to be the case. However, nothing is yet known about the effects of these hormones on offspring development. Our aim is to assess the impacts of yolk stress steroids on learning ability in birds. We are using Japanese quail as our study species because they breed well in captivity and much is known about their basic biology. We have implanted the laying females with stress hormones, having shown that this will increase levels of stress hormones in their eggs. We will raise the chicks from eggs laid by birds implanted with stress hormones and by birds with empty implants. The ability to learn in treated and control birds in maze experiments will be compared. If we find that the stress experienced by laying birds and the resultant increase in cortisone deposition in eggs reduces the learning ability of their offspring, this may have implications for captive breeding programs or for management of bird populations in the wild.

POSTER SESSION

OBTAINING LARGE GRAIN SIZES WITH MAGNESIUM OXIDE DOPED ALUMINUM OXIDE

TIMOTHY CHIN, Materials Science and Engineering, Junior, MARY GATES SCHOLAR, GOLDWATER SCHOLAR
RAJENDRA BORDIA, *Materials Science and Engineering*

Large grain sized ceramic materials are necessary to further study microstructural toughening mechanisms and microcracking effects on material properties. For aluminum oxide, large grain sizes ($>20\ \mu\text{m}$) are difficult to achieve without obtaining abnormal grain growth (elongated grains). This research investigated the effects of various heat treatment (sintering) schedules and processing parameters on the grain growth of aluminum oxide. It was found that at exaggerated sintering times ($>48\ \text{h}$) and/or temperatures ($>1750^\circ\ \text{C}$), abnormal grain growth would occur. However, when utilizing a multi-stage sintering process, abnormal grain growth could be prevented even when sintering for long times at high temperatures. Another mechanism used to control grain growth was doping the aluminum oxide with magnesium oxide at 500 parts per million. Combining the doping and multi-stage sintering processes, grain sizes from $27 - 99\ \mu\text{m}$ have been attained.

TRACKING T CELL CLONES SPECIFIC FOR HERPES SIMPLEX VIRUS IN IMMUNE SERONEGATIVE HUMANS

ANGELA CHINTELLA, Cellular and Molecular Biology, Senior, MARY GATES SCHOLAR
CHRISTINE POSAVAD, *Laboratory Medicine*

Herpes simplex virus type 2 (HSV-2) causes genital herpes, a medically significant sexually transmitted disease to which there is no effective vaccine. Most studies indicate that T cells are correlated with the control of HSV-2 in animal models and in humans. However, the aspects of T cell immunity important for this control are not known. The design of a prophylactic vaccine against HSV-2 necessitates an understanding of the requirements for protective immunity. One population that may provide insights into protective immune mechanisms are individuals repeatedly exposed to HSV-2 but who remain uninfected. We have identified immunocompetent individuals seronegative for HSV-1 and -2 who possess CD4+ and CD8+ T cells specific to HSV-2. These "immune seronegative" (IS) individuals show no evidence of HSV infection when mucosal sites were sampled for the detection of infectious virus or viral DNA. In order to evaluate the persistence of the HSV-specific T cell response in IS subjects, we utilize a technique previously shown to longitudinally track HSV-specific T cell clones in HSV-2 seropositive individuals with frequently recurring genital HSV-2 disease. Each T cell clone specific for HSV-2 is isolated and the unique T cell receptor gene is characterized. Whole cell RNA is extracted and cDNA synthesized using reverse transcriptase and polymerase chain reaction (PCR). The T cell receptor gene is then sequenced allowing us to design a specific oligonucleotide probe used in a liquid hybridization assay to track each clone in peripheral blood mononuclear cells isolated over a period of 4 years from each IS subject. The data we obtain on the persistence of these T cell clones from IS subjects may provide insight into one potential mechanism of resistance to HSV in these subjects.

POSTER SESSION

THE EVOLUTION OF IMMIGRANT CULTURES: DEFINING THE SECOND GENERATION TAIWANESE AMERICAN IDENTITY

BRYAN CHOU, Community and Environmental Planning, Senior

CHRISTOPHER CAMPBELL, *Community and Environmental Planning*

During the 1960's through the 1970's, there was a wave of immigration from the small island of Taiwan referred to as the "Brain Drain." They came to continue their education in the prestigious graduate schools of the USA. Some of them returned to their island home; many of them stayed in the new land of opportunities. For those that remained, they created a new American sub-culture where they balanced their Taiwanese influences with their new surroundings. Forty years later, there is a new Taiwanese American ethnicity that has emerged. The second generation Taiwanese Americans are taking their parents' created ethnicity and reshaping it as they establish themselves in American life. They venture forth beyond where their parents' footsteps left off. What direction is this new ethnicity taking? What are the influences that drive them? How strong are their ties to the past and their origins? How deeply do they identify with each part of their two cultures? These are the questions that I am exploring and documenting through interviews with 2nd generation Taiwanese Americans.

PHOTO INDUCED ELECTRON TRANSFER FROM AN ADSORBED ELECTRON DONOR TO A SEMI-CONDUCTOR

CALLEY CHRISTIE, Biochemistry, Senior

OLEG PREZHDO, *Chemistry*

WILLIAM STIER, *Chemistry*

Photo induced electron transfer (ET) from a light activated electron donor to a semi-conductor substrate has been the subject of intense research in recent years. Such reactions occur in dye sensitized nanomaterials such as solar cells, and processes such as photocatalysis, and photoelectrolysis. These reactions have been investigated using a model system consisting of a simplified dye bonded to a semi-conductor substrate. Adiabatic molecular dynamics (MD) were conducted using Density Functional Theory to determine the ionic motion of the system. Non-adiabatic MD were then performed using the quantum-classical meanfield approach to resolve the evolution of the ET reaction. Both adiabatic and non-adiabatic ET were observed in this system. Adiabatic ET occurred more slowly, approaching asymptotically the total ET due to non-adiabatic ET which occurs primarily over a relatively shorter time period. The simulation predicts a complex non-single-exponential mechanism of electron transfer.

POSTER SESSION

MICROBIAL DIVERSITY OF AN UNUSUAL, PERIDOTITE-HOSTED HYDROTHERMAL FIELD NEAR THE MID-ATLANTIC RIDGE

P.J. CIMINO, Biochemistry, Junior, MARY GATES SCHOLAR, SPACE GRANT SCHOLAR
DEBORAH KELLEY, *Oceanography*
JOHN BAROSS, *Oceanography*

The Lost City (LC) Hydrothermal Field is a unique peridotite-hosted vent environment discovered in December 2000 near the Mid-Atlantic Ridge. This field contains large (up to 60 m) carbonate chimneys venting high pH (9-10), moderate temperature (45°-75° C) hydrothermal fluids. Geologic settings similar to the LC field are abundant in the world's oceans and may be similar to mafic-rich, reducing hydrothermal environments present on early earth. In order to characterize the microbial communities inhabiting this novel environment, microscopic and molecular techniques were applied to chimney samples from LC to map the abundance and diversity of microorganisms. Preliminary results indicate cell densities of 10⁷ to 10⁸ cells per gram of material in the various samples. Unusually, 4-11% of the microbial population in direct contact with vent fluids fluoresces with Flavin-420, a key coenzyme in methanogenesis. Enrichment culturing in media for Methanogens, Methane-oxidizers, and Sulfate-reducers yielded positive enrichments at 50° C, and heterotrophic microorganisms at 70° C. PCR analysis of rock samples indicates the presence of both Archaea and Eubacteria. Understanding the microbial ecology of present-day peridotite-hosted hydrothermal systems is important as LC may be the closest analogue available to study hydrothermal vent systems on early earth and the life that they support.

MAPPING THE ROMAN AND BYZANTINE SETTLEMENTS OF NORTHWEST ANATOLIA: CARTOGRAPHY FOR THE TAHIRLER PROJECT

GREGORY CIVAY, Anthropology, Senior, MARY GATES SCHOLAR
JOEL WALKER, *History*

Since 1999, I have served as the cartographer for the Tahirler project, a multi-year archaeological survey studying the rural life and the Roman/Byzantine road system of northwestern Anatolia (Turkey). The primary goals of the project are to elucidate the relationship between this region's modern topography and the Roman/Byzantine road system, and to create an annotated catalogue of the archaeological sites in the Tahirler project's survey area. In addition to sites from the Roman/Byzantine period, the project has identified and documented several important pre-classical (Hittite, Galatian) fortresses. It has been my responsibility to research the topography of the region, create maps, and set up methodology for the field survey. Prior to our fieldwork in Turkey during September 8-24, 2001, I correlated the information from several other maps (including a Russian military map) to create base-maps for our fieldwork. During the survey I updated the base-maps and used an Electronic Total Station, along with GPS (Global Positioning System) and standard surveying techniques to create maps of various sites from within the survey area. The maps and data collected during the 2001 field season have enabled us to obtain a more accurate picture of the region, as it existed in the Byzantine Period. The project itself will continue until all the sites in the area are fully documented.

POSTER SESSION

GENE INACTIVATION STRATEGIES FOR THE SALMON PATHOGEN CAUSING BACTERIAL KIDNEY DISEASE

ALISON COADY, Microbiology, Junior
LINDA RHODES, Northwest Fishery Science Center
MARK STROM, Northwest Fishery Science Center

Renibacterium salmoninarum is the causative agent of bacterial kidney disease (BKD), a devastating bacterial infection affecting salmon and trout. *R. salmoninarum* produces large quantities of the protein major soluble antigen (MSA). MSA has been identified to be important to virulence and is encoded by duplicate genes. Isolating a mutant with both MSA genes inactivated would allow characterization of the importance of this protein in virulence. To create such a mutant, both random and directed mutagenesis have been attempted. For random mutagenesis, transposons (genes capable of transferring into DNA sequences) were transformed into *R. salmoninarum*. A transposon inserted into the middle of an MSA gene could inactivate the gene. For directed mutagenesis, a non-functional copy of MSA, which could replace the wild type gene through allelic exchange, was used. Current results suggest that the transposon genes Tn5, Tn10, and Tn916 are not mobilized by *R. salmoninarum* and, therefore, ineffective at mutagenesis. Similarly, allelic exchange has not occurred. Instead, the non-functional gene has inserted adjacent to the chromosomal copy. Recently, we have discovered that a green fluorescent protein (GFP) reporter gene controlled by a region of the MSA promoter precisely integrates by homologous recombination, suggesting a new mutagenesis strategy. If this approach generates the desired mutant, it will be tested for virulence and as a vaccine candidate.

THE USE OF GESTURE TO FACILITATE EXPRESSION OF FALSE BELIEF UNDERSTANDING IN YOUNG CHILDREN

CARON COSSER, Psychology, Senior
STEPHANIE CARLSON, Psychology

Research has shown that early understanding of complex concepts can be expressed through gestures rather than speech. This study examined whether gesture might also reveal young children's development of theory of mind (i.e. understanding of mental states). Thirty-four children (17 3-year-olds and 17 4-year-olds) were tested on two false belief tasks: the Gesture Task and the Novel Word Task. In the Gesture Task, children were introduced to two novel objects and taught to label them with gesture "names" (mixing action or pull action). Objects were then placed in boxes with corresponding pictures affixed to the outside and moved out of sight. The false belief test followed, in which children were presented with another box labeled with a picture of one object, but actually containing the other. Children were then asked a false belief question for self ("Before we opened the box, what did you think was inside?"), a false belief question for other ("Ernie has never looked inside this box before, what does he think is inside?") and a reality control question ("What's really inside?"). The Novel Word Task followed the same procedures except that two additional objects were used and given novel word names ("kayloo" and "modi"). A 2 (age group) x 2 (order) x 2 (condition) ANOVA revealed a main effect for age and a significant interaction between age and condition. Specifically, 4-year-olds performed better on the Gesture Task than on the Novel Word Task, while the opposite was true for 3-year-olds. The results support the idea that an understanding of false belief can be expressed more easily through gesture than speech in 4-year-old children, who are likely to be in a transitional state of theory of mind development. A follow-up study is examining 4-year-olds' performance on standard, gesture and verbal false belief tasks in a between-subjects design.

POSTER SESSION

DISCOVERING HIERARCHICAL STRUCTURE IN BACH

ERIN EARL, Music, Piano, and Computer Science, Senior, MARY GATES SCHOLAR
RICHARD LADNER, Computer Science and Engineering

Musicians and mathematicians alike have long speculated that a great deal of complex structure exists in music composed by Johann Sebastian Bach. Recently there has been an explosion of lossless data compression algorithms that detect hierarchy in strings through exploiting repetition; one of the first and most elegant was the SEQUITUR algorithm developed by Craig Nevill-Manning and Ian Witten in New Zealand. A natural question that arises is: Can these data compression algorithms be used to discover hierarchical structure in music? This is the question that my research tries to address. The approach that we use is very simple: first digitize the sheet music manually, then run an algorithm on it and finally analyze the output. However, we are planning a collection of algorithms to run so that we can compare their outputs: we have the basic on-line SEQUITUR algorithm, a few similar off-line algorithms and finally, a modified version of SEQUITUR designed to try to take into account certain musical operations. That is, we are modifying the basic SEQUITUR algorithm to exploit not only exact repetition but also transpositions and inversions. At this point, we have run SEQUITUR on short fragments of pieces with encouraging results. This shows that music samples of Bach do indeed have some hierarchical structure. We expect that the modified algorithms will find even more structure in music.

DIAGNOSTIC TEST DEVELOPMENT OF A REAL-TIME PCR TEST FOR THE ADENOVIRUSES

ERIN ENGELSON, Microbiology, Senior, MARY GATES SCHOLAR
LARRY COREY, Virology Department
MEEI-LI HUANG, Molecular Diagnostics

The adenoviruses are some of the many pathogens and opportunistic agents that can cause severe disease and high mortality rates in immunocompromised populations. While researchers still work to learn more about these agents, rapid and sensitive tests are essential to the clinical management of adenovirus infections. Advances in PCR and real-time technology have led our group into developing a series of tests to detect many of the various serotypes of the adenovirus. Specifically we have designed several tests using the Taqman PCR detection system that takes advantage of the 5' exonuclease activity of Taq polymerase to digest an internal fluorescent-dye marked probe. The probe and the dyes within undergo fluorescent resonance energy transfer (FRET) prior to cleavage and viral nucleic acid quantities are determined based on the increase of fluorescence. This technology has created a test that is both more sensitive and more rapid than previous detection methods and is therefore more useful to both the clinician and patient who rely on rapid, sensitive diagnostic tests.

NEUROGENESIS OF CORTICAL LAYERS IN NORMAL AND *REELER* MUTANT MICE

CHRIS ENGLUND, Neurobiology, Senior, MARY GATES SCHOLAR
ROBERT HEVNER, Pathology

The organization of the cerebral cortex into six layers of neurons takes place during embryonic development as neurons are born in the ventricular zone and migrate radially towards the pial surface. This migration takes place such that the deeper layers of the cortex are made up of older neurons and the superficial layers are made up of younger neurons, which migrate past the existing layers. In the mutant mouse strain *reeler*, the cortex is inverted such that the older neurons are superficial and the younger neurons are deep. We have used this model to characterize the birthdates of cells that express layer-specific markers and their subsequent placement in the disorganized *reeler* cortex. The birthdating molecule bromodeoxyuridine (BrdU) was administered on each day of neurogenesis in

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the cortex (embryonic day(E) 10.5 - E16.5) and all animals were sacrificed on the day of birth (P0). Antibodies against the following markers were used to define the layers: Calretinin (Layer 1), ROR β (Layer 4), SCIP (Layer 5), ER81 (Layer 5), Tbr1 (Layer 1, Layer 6 & Subplate). Our preliminary results show that: 1) neurons fated to different cortical layers are born during broadly overlapping periods of neurogenesis; 2) cortical neurons migrate to a radial position appropriate for their molecular phenotypes, regardless of their birthdate; 3) the temporal pattern of neurogenesis and differentiation of cortical neurons is unaltered in *reeler* mutant. Our findings show that neurogenesis in the cortex is a more complex process than was previously thought. We have shown that an altered cortical environment does not affect the laminar fate of a neuron and that the laminar fate of a neuron is not tied to a specific day of birth, but to the cell's molecular characteristics after it has differentiated.

MODULAR MICROFLUIDIC FLOW CHANNELS

AZIEL EPILEPSIA, Electrical Engineering, Freshman

RYAN LAUNTZ, Pre-Engineering, Freshman

SHENG XU, Pre-Engineering, Freshman

Yael HANEIN, *Electrical Engineering*

MARK HOLL, *Electrical Engineering*

Our research project entails the compilation of a library of standard microfluidic flow channels as well as the design of new research devices. Our microfluidic channels are modular, flexible silicone based constructs fabricated with the intent of guiding minute volumes of fluid from a sample vial, to the surface area of a substrate. The benefits of these devices include batch fabrication and reusability. Applications of these devices range from educational purposes, to actual research in the laboratory for various functions, such as single cell sorting, retrieval of specific individual cells, hydrophobic microfluidic devices, etc. The fabrication of these microfluidic devices entails the use of photolithography techniques to create the channel design on the surface of silicon wafers. By implementing successive steps of molding and casting the final microfluidic device is obtained.

MECHANISMS OF BACTERIAL LIPOPOLYSACCHARIDE ENHANCEMENT OF SHIGA-LIKE TOXIN-INDUCED ENDOTHELIAL CELL APOPTOSIS

RYAN ERWERT, Biochemistry, Senior

DOUGLAS BANNERMAN, *Surgery*

Hemolytic uremic syndrome is the leading cause of acute renal failure in children under the age of 10. It is characterized by vascular endothelial injury, intravascular coagulation, and deposition of fibrin and platelets in the glomerulus, ultimately leading to decreased blood flow in the kidney. It has been proposed that Shiga toxin or Shiga-like toxins (SLT) produced by the pathogenic bacteria *Shigella dysenteriae* and *Escherichia coli*, respectively, contribute to the endothelial injury. Although SLT-1 alone has been reported to induce endothelial cell (EC) apoptosis, several reports demonstrate that bacterial lipopolysaccharide (LPS) enhances this effect. The mechanism by which LPS synergistically enhances SLT-mediated apoptosis remains unknown. Interestingly, protein synthesis inhibition sensitizes EC to LPS killing. One report suggests that this event is due to the inhibition of the synthesis of the anti-apoptotic protein FLIP, and the rapid degradation of existing FLIP levels. SLT has been reported to inhibit new protein synthesis. This may suggest that SLT-1 sensitizes EC to LPS killing by decreasing the expression of anti-apoptotic proteins. By using caspase activity as a measurement of apoptosis, we have confirmed that while LPS alone does not effect caspase activity, SLT-1 alone does increase EC caspase activation. Consistent with previous reports, the combination of LPS and SLT-1 resulted in a synergistic enhancement of apoptosis. To determine

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whether SLT-1 inhibits anti-apoptotic proteins, we treated EC with medium, LPS, SLT-1, or SLT-1/LPS, and assayed for anti-apoptotic protein expression by Western blot analysis. The results showed a decrease in expression of FLIP and Mcl-1 when treated with SLT-1 and SLT-1/LPS, but not with LPS alone. This suggests that the synergistic enhancement of LPS/SLT-1 apoptosis is mediated by SLT-1-induced reduction in Mcl-1 and/or FLIP expression, leading to the sensitization of EC to LPS killing.

CORTICAL RECORDINGS FOLLOWING TRAUMATIC BRAIN INJURY IN THE RAT: A MODEL FOR INVESTIGATING POSTTRAUMATIC EPILEPSY

JARED FAIRBANKS, Neurobiology, Senior
RAIMONDO D'AMBROSIO, *Neurological Surgery*

Epilepsy is a neurological disorder that sometimes follows traumatic brain injury. The time from the initial injury until onset of epilepsy can vary from months to years. There are currently two models used to study posttraumatic epilepsy. One consists of incisions in the rat brain; the other consists of implanting iron oxide in the cortex. Both models develop local abnormal neuronal activity, yet they may not relate to what happens in humans, where the injury that best correlates with onset of chronic seizures is penetrating injury. Long-term studies following a penetrating injury model have not been studied yet. To fill this gap in the literature, we propose a rat animal model that will allow us to study clinical and sub-clinical epileptic activity from 1 to 4 months following traumatic brain injury. Two experimental groups will be used with ten rats in each set. We will injure the first set of rats using a stab wound injury obtained by vertically inserting a needle in the rat neocortex. The second set will be sham-operated rats that will serve as controls. One week after injury, epidural cortical electrodes will be implanted in the skull of the animals. The electrodes will be connected to a pedestal that will be fixed to the animal's skull by acrylic glue to allow us to connect the rat to the recording instruments. Two weeks after the initial injury, recordings will begin; each rat will be monitored over a period of four months. To determine seizure threshold for detection, we plan to inject a known amount of pentylenetetrazole, a known cause of seizure activity. Preliminary pilot rats have demonstrated successful recordings.

LISTENING TO THE LEARNER

MIRANDA FAIRBROOK, Philosophy and Drama, Senior
BETH KOEMANS, Informatics, Senior
SCOTT MACKLIN, *Program for Educational Transformation Through Technology*

As technology has become more prevalent in the academic environment, a great deal of research has been conducted investigating the perceptions people have about technology. In particular these studies have focused on people who lack confidence in their ability to use technology, their self-efficacy, their prior experience, and their gender. However, there has been little research studying how an instructor's presentation of educational technology affects student confidence levels with the use of those technologies. The purpose of this project is to investigate how the method instructors use to introduce and integrate computer technology into their classroom affects students' confidence in their ability to perform the required tasks. I will define computer technology as: E-Post message boards, online peer review, the uploading and downloading of files, and the use of e-mail attachments. The methodology I intend on implementing involves a qualitative approach. I will facilitate two focus groups with the target population being those University of Washington undergraduates who describe their ability to perform required tasks involving computer technology as low. The data collected from these focus groups will aid in the development of a survey, which will be distributed to a general population of UW undergraduates. Ultimately, my goal is to make recommendations to instructors as to how to most effectively introduce and integrate computer technology into the classroom, while being sensitive to the various levels of student confidence.

POSTER SESSION

REFUGEE POLICY

GENA FEDORUK, Political Science, Junior

BRYAN JONES, Political Science

HEATHER LARSEN, Political Science

How and why has congressional attention to refugee issues and refugee policy changed over time? Do external shocks to the system, such as the Mariel Boat lift, or the Elian Gonzalez case, cause increases in attention? In order to analyze this question I will focus on two data sets, congressional hearings and INS statistics. The congressional hearings data set will be accessed from the Policy and Agendas Project at the University of Washington. The INS statistics data set includes annual reports and a statistical yearbook on refugees granted residency. The dependent variable, congressional attention, will be measured by congressional hearings from 1947-1999. The independent variable will be the INS statistics. I anticipate a positive relationship between INS statistics and congressional attention. By examining external shocks to the system and relating each event to the data measured by congressional hearings and INS statistics an increase in congressional attention will be depicted.

FMRI REGIONAL BRAIN ACTIVATION DIFFERENCES BETWEEN CHILD DYSLEXICS AND CONTROLS

KATHERINE FIELD, Psychology, Senior

AMIE GRIMME, Neurobiology, Senior, MARY GATES SCHOLAR

ELIZABETH AYLWARD, Radiology

TODD RICHARDS, Radiology

Dyslexia, or reading disability, may affect as much as 5-15% of the population. The focus of our study is to (a) investigate differences in brain activation between dyslexic and control subjects during two different reading tasks and (b) determine the effects of educational treatment on brain activation during these tasks. Our sample consisted of ten dyslexic and eleven normal children. The groups were matched on age and verbal IQ. Two separate functional magnetic resonance imaging (fMRI) scans were performed to assess brain activation during phoneme mapping and morphological processing. During the phoneme mapping task the child indicated whether letter combinations in visually-presented pseudo-words made the same sound (e.g., does the "ea" in "brean" make the same sound as the "ee" in "flead"?). During the morphological processing task the child indicated whether a visually- and auditorally-presented word could stem from another word (e.g., does "builder" come from "build"?). The fMRI scans were repeated for each subject after an interval of several months. In the period between the two sessions, the dyslexic subjects underwent 28 hours of intensive training in phonological and morphological processing over a period of three weeks. At the initial scan, the dyslexic subjects had significantly less activation than control subjects in the parietal-occipital junction, middle frontal, fusiform and inferior temporal gyri for the phonological task and significantly less activation in the occipital gyrus and inferior parietal lobule for the morphological task. Following educational treatment, these differences were no longer observed. These results suggest that the dyslexic subjects were successfully trained to perform morphological and phonological processing more efficiently, using brain pathways similar to those used by normal readers. Further investigation in this study will include quantitative assessment of brain activity for individual subjects during the two tasks.

POSTER SESSION

CHARACTERIZING MOTILITY IN *HETEROSIGMA AKASHIWO*

MARY ANN GALAGATE, Cellular and Molecular Biology and Spanish, Senior, MARY GATES SCHOLAR
ROSE ANN CATTOLICO, Botany

Spontaneous algal blooms can have dramatic effects on the ecosystem of a marine environment. Toxic algae are detrimental to the survival of fish, oysters, phytoplankton and other organisms and thus can effectively impact the economy. *Heterosigma akashiwo* is a brown chromophytic alga that is able to swim upward to the water surface early in the day and swim downward just before nightfall. The cause of this swimming pattern is unknown. However, it is hypothesized that this behavior serves as a survival mechanism because the alga can access nutrients that are more abundant in deeper water and utilize daylight for photosynthesis in more shallow water. Observance of *Heterosigma Akashiwo* cells was done to better understand the cause for swimming patterns. *Heterosigma akashiwo* cells can be closely monitored and visualized using a special apparatus that is available in Dr. Grünbaum's laboratory in Oceanography. A camera that amplifies the cells is attached to a monitor, and the cells are added into a cylindrical chamber that contains 800mL of a shallow salinity gradient. Photographs of the cells taken throughout the day are stored in a computer. This data then allows us to analyze swim direction, swim speed, and density of the cells at certain horizons during the day. The characterization of general swimming patterns in ideal experimental conditions through the course of the day may serve as a baseline for future experiments with the algae cells. Changes in light intensity/color or changes in nutrient availability within the chamber can be analyzed to determine if these environmental cues alter swimming patterns. Alterations in swimming patterns may lead to physiological changes within the cell in response to stresses. Characterizing cell motility in *Heterosigma akashiwo* may lead to a better understanding of how and why spontaneous blooms of algae occur.

BA(MG? TA?)O₃ MILLIMETER/SUB-MILLIMETER RIBBON WAVE-GUIDES

DOUG GLINIAK, Ceramic Engineering, Senior
RAJENDRA BORDIA, Materials Science and Engineering
S.K. SUNDARAM, Materials Science and Engineering

Thin ribbons of Ba(Mg? Ta?)O₃ or "BMT" may allow for an effective increase in attenuation performance over conventional alumina for use in millimeter/sub-millimeter wave-guide applications. Experimental results have already shown that low-loss characteristics can be obtained through ribbon geometry with 10:1 aspect ratio using Coors' 998 Alumina. BMT has a higher dielectric constant ($\epsilon=24$) and lower tangential loss ($\tan d=3.80 \times 10^{-5}$) than alumina ($\epsilon=10$ and $\tan d=1.00 \times 10^{-7}$), potentially decreasing the attenuation below current 10 dB/km levels. Crystallization from a glass matrix, and nanoscale powder synthesis were both investigated as processing methods for BMT. Potential applications of this research include: new method of processing BMT and potential attenuation improvements at millimeter/sub-millimeter frequencies.

POSTER SESSION

THE RELATIONSHIP BETWEEN POLITICAL IDEOLOGY AND COLLEGE MAJOR

KRISTI GOVELLA, Political Science and Business, Junior
ANA MARI CAUCE, Psychology

This study examines the relationship between students' political attitudes and their choice in college major. Is it true that liberals choose to study political science while conservatives gravitate toward business and economics? Also, does this happen because students choose majors consistent with their beliefs or because courses of study tend to mold students into a certain frame of mind? After a review of the existing literature, I found that surprisingly few studies address these questions. I will address them by polling students enrolled in selected majors at the University of Washington and asking them questions on polarizing issues in an attempt to unravel their political stances. I will examine the data to identify a correlation between ideologies and majors, while also comparing students of different class standings within the same declared major. This second query will focus on whether beliefs tend to change after the student has been enrolled in a major for an extended period of time. This research project will provide an interesting insight into the UW student body. It may tell us much about why we make important life decisions and how these decisions in turn shape the way we think.

A VERSATILE APPROACH FOR CREATING CELL MICROPATTERNS

BORIS GRIN, Bioengineering and Neurobiology, Senior, MARY GATES SCHOLAR
ALBERT FOLCH, Bioengineering
ANNA TOUROVSKAIA, Bioengineering

Many cell processes are regulated or triggered by various local environmental cues, e.g. local concentrations of ions and nutrients, the biochemical composition of the substrate, or the presence of other cells. Microfabrication techniques allow scientists to control these parameters in culture. We have developed a novel technique for patterning cells on a micrometer scale. Our methodology combines soft lithography and surface modification techniques. A thin (~100 nm) layer of polyethylene glycol (PEG), a polymer that repels cell and protein adhesion, is chemically grafted onto glass. The PEG is selectively removed by exposing the surface to oxygen plasma through an elastomeric stencil in contact with the PEG; the areas contacted by the stencil are protected from the plasma whereas the PEG exposed to the plasma through the stencil holes is removed. The underlying glass is not affected by the plasma etch. The stencil is microfluidically molded in polydimethylsiloxane (PDMS), by creating posts on a silicon substrate then covering them with a cap and filling the created space with PDMS. Fibronectin, an adhesive protein is then adsorbed onto the bare glass islands left by the etching process. Cells seeded on this surface only attach to the fibronectin-coated areas. The PEG areas surrounding the cellular islands are effective in preventing cell spreading and migration in serum-containing medium for periods of time over three weeks.

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COMPUTER VISION: PARTICLE TRACKING IN APPLICATION TO CLOSED ECOLOGICAL SYSTEMS

MICHAL GUERQUIN, Applied and Computational Mathematical Sciences, Junior
ZACH FRAZIER, Applied and Computational Mathematical Sciences, Senior
FRIEDA TAUB, School of Aquatic and Fishery Sciences

Methods of counting large numbers of moving organisms are needed in Closed Ecological Systems, as well as many other types of population research. In this paper we present a computer vision system designed for this purpose. The system is capable of discriminating objects from background noise, and classifying them based on user-defined criteria such as size, brightness or motion patterns. When given successive frames, the system is capable of tracking and reporting on the motion of the objects it finds. It is capable of handling objects which move quickly and sporadically, which is often the case for small organisms. Alternative applications from other fields include star counting, particle tracking in fluid dynamics, and material sciences.

LUXS DEPENDENT GENE REGULATION IN *PORPHYROMONAS GINGIVALIS*

PAMELA GUSTAFSON, Microbiology, Senior, MARY GATES SCHOLAR
RICARDO LAMONT, Oral Biology

The colonization and invasion of periodontal (gum) tissue by pathogenic organisms leads to inflammation (gingivitis) and eventually to periodontitis, one of the most common diseases of mankind. *Porphyromonas gingivalis*, a late colonizer of dental plaque, has been implicated as a key pathogen involved in adult onset periodontitis. Inter- and intra-species communication between oral bacteria facilitates colonization, and *P. gingivalis* has been found to have quorum sensing (density dependent gene regulation) communication system based on the LuxS signaling molecule. The goal of this project is to identify genes of *P. gingivalis* that are regulated in response to the LuxS signal. *P. gingivalis* genes under the control of LuxS were identified using differential display (DD) RT-PCR. *P. gingivalis* cells were exposed to LuxS from a biofilm partner species, *S. gordonii*. Culture supernatant from a LuxS-null mutant of *S. gordonii* was used as a control. Cells were grown to mid log phase, and total RNA was isolated from both cell populations. cDNA was synthesized and amplified with random primers. PCR products were displayed on a gel and differentially expressed bands were excised, cloned and sequenced. BLAST searches then reveal the identity of the regulated gene. Thus far, several genes that are differentially expressed in response to *S. gordonii* LuxS have been identified. These include the potassium uptake gene TrkA, a TPR domain protein, and a gene of unknown function. The biological relevance of these remains to be established and as research continues a clearer picture will emerge of their role in colonization, biofilm formation and invasion. From this picture, targets for treatment of *P. gingivalis* may be identified which could eliminate or reduce the severity of associated disease.

PASSDOODLE USER STUDY: DOODLING OUR WAY TO A BETTER AUTHENTICATION METHOD

JENNIFER HAGMAN, Informatics, Senior, MARY GATES SCHOLAR
JOSEPH GOLDBERG, Informatics, Senior
GAETANO BORRIELLO, Computer Science and Engineering

Anyone who has used computers and the Internet will agree that passwords play a large role in keeping personal information safe. Password security often fails in practice because users select predictable passwords. In this project, we conducted a user-study with a pen and paper prototype of a Personal Data Assistant (PDA), based on a hand-drawn doodle password, or "passdoodle". The passdoodle software is being developed by students in the department of Computer Science and Engineering. The purpose of this user-study was to explore the use of

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passdoodles versus traditional alphanumeric passwords. We had several research questions. First, we sought to determine whether passdoodles are easier for individuals to remember and deemed more secure than alphanumeric passwords. Additionally, we aimed to investigate which authentication method participants prefer, which method is perceived as easier to remember, and whether users are able to redraw passdoodles the same way (by using identical pen-strokes) during password recall. Our findings show that participants could recall all visual elements of the passdoodle as well as they could recall alphanumeric passwords. Yet most could not perfectly redraw their selected doodles. In other words, users could duplicate the complete image but generally did not use the same order of pen-strokes in doing so. Moreover, users generally perceived passdoodles as easier to remember than alphanumeric passwords; yet they preferred whichever authentication method they perceived to be more secure. The results are promising in that participants generally welcomed the idea of doodle passwords, given the challenge of user acceptance when introducing new technologies. We suggest that future versions of the passdoodle program account for “visual matches” of complete images rather than only accepting matches based on specific pen-stroke order.

ROLES OF CYCLIN KINASE INHIBITOR DURING ARABIDOPSIS ORGANOGENESIS

LAUREL HANSON, Botany, Senior

KEIKO TORII, Botany

ANNSLADE, Botany

LUCA COMAI, Botany

KAREN WOLFF, Howard Hughes Medical Institute and Fred Hutchinson Cancer Research Center

JAMES M. ROBERTS, Howard Hughes Medical Institute and Fred Hutchinson Cancer Research Center

Development of multicellular organisms requires highly coordinated cell proliferation. Elucidating the interplay of cell cycle machinery and genetic programs that specify organ growth remains a challenging, yet exciting question in developmental biology. In mammals, a cyclin-kinase inhibitor, p27kip1, governs the timing of cell proliferation to differentiation. Consequently, p27kip1 knockout mice show an increase in overall size (hyperplasia) as cell differentiation is delayed. We aim to determine whether organogenesis of higher plants requires programmed suppression of cell proliferation by cyclin kinase inhibitors. Toward this goal, we isolated seven *Arabidopsis* homologs of p27kip1 by yeast two-hybrid screen using *Arabidopsis* cyclin D as bait. To understand the in vivo roles of these Atp27kip1s, we generated transgenic plants that co-suppresses one of the Atp27kip1s, KRP1, by double-strand RNA interference (RNAi, IR). Several transgenic lines exhibited multiple carpel phenotypes resembling those of the *Arabidopsis clavata* (*clv*) mutants, in which the differentiation of meristematic cells in the center of the shoot meristem (SM) is delayed. We generated double mutants of KRP1 RNAi lines with *clv-1* and *clv-3*. The double mutants all resemble the *clv* single mutant, indicating the possibility that differentiation of stem cells by CLV may involve cyclin kinase inhibitors.

MAXIMUM STARTUP DELAY GUARANTEE FOR MEDIA-ON-DEMAND OVER

DAN HOKE, Computer Engineering, Senior

RICHARD LADNER, Computer Engineering

The proliferation of streaming media over the Internet has made efficient media delivery a critical factor in minimizing wasted bandwidth. Traditionally, we think of media as being streamed similar to radio: sequentially. With a computer, however, we can use multiple channels and buffering to efficiently deliver a media piece by dividing it and delivering the pieces simultaneously. With careful scheduling, we can serve this media continuously and reduce the amount of time an arbitrary number of receivers need to wait to begin playing to an insignificant amount. This research explores several algorithms for generating these schedules as well as their effectiveness in using the fewest broadcast channels with the least wait time.

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MESIAL TEMPORAL SCLEROSIS: A RETROSPECTIVE ANALYSIS OF SURGICAL OUTCOMES IN EPILEPSY PATIENTS

STEVEN HARDY, Comparative History Of Ideas and Neurobiology, Senior, MARY GATES SCHOLAR
JOHN MILLER, Neurology

Epilepsy is a neurological disorder that affects 1% of the general population in the world. The World Health Organization estimates 50 million people with epilepsy worldwide at any given time. The disorder is characterized by recurring episodes of abnormal electrical activity in the brain (seizures). Clinically, seizures can cause many different manifestations including loss of consciousness and involuntary movement. Although seizures may be controlled with medication in the majority of patients, when they are uncontrolled, they lead to disability and potential injury. Some patients with uncontrolled epilepsy are treated with brain surgery. This study is designed to look at a subgroup of patients receiving surgery, and determine what foretells a good surgical outcome. Mesial temporal sclerosis (MTS) is scarring of a deep structure of the brain (the hippocampus) which is thought to cause seizures. Most MTS patients do not respond to medication but surgical removal of this tissue leads to seizure control for approximately 70% of them. Our question is, *what factors predict attainment of seizure control after surgical treatment of MTS?* Examples of predictors studied include 1) side of operation 2) age of onset 3) baseline intellectual capacity 4) diagnostic testing results 5) age of onset 6) trauma history 7) birth injury. Our study targets a subgroup of epilepsy patients (n = 119) who have been pathologically verified with MTS and have a minimum one year follow-up evaluation. By knowing the long-term outcomes of these patients (i.e., seizure-free status), definitive results can be drawn about the predicting factors of surgical outcome in MTS patients. This will lead to better selection of patients for surgery, and better understanding of why the operation doesn't always work.

IDENTIFYING THE GENE IN HUMAN CYTOMEGALOVIRUS RESPONSIBLE FOR THE COMPLEMENTATION OF A MUTANT VACCINIA VIRUS

VICTORIA HARPER, Biochemistry and Microbiology, Senior, MARY GATES SCHOLAR
ADAM GEBALLE, Medicine

Human cytomegalovirus (HCMV) must overcome the natural defenses of the cell in order to establish productive infection. These obstacles include the PKR and RNase L pathways, both of which are induced by interferon α and believed to be activated by dsRNA. HCMV appears to have mechanisms to overcome these pathways as evidenced by the discovery that HCMV complements a mutant Vaccinia virus with a deletion of the E3L gene. The E3L gene is a dsRNA binding protein that blocks the activation of the PKR and RNase L pathways. In human fibroblasts (HF), the mutant virus fails to replicate well compared to wild type Vaccinia. However, when HF that have been previously infected with HCMV are infected with the mutant virus, productive infection is established as observed by plaque assay and by measurement of β -galactosidase activity. Our lab is currently working on determining the identity of the HCMV gene responsible for the complementation of the Vaccinia virus Δ GE3L mutant. The HCMV genome is expressed temporally and generally genes are classified as immediate-early, early, or late, with the final group expressed following the onset of viral DNA replication. In order to determine the kinetic class of the gene, infection was carried out in the presence of the drug ganciclovir (GCV), which is activated by HCMV and prevents DNA replication of the virus. Complementation occurred regardless of the presence of GCV, this suggesting that the gene involved is not a late gene. To identify this gene, our lab has created a strategy to introduce a library of HCMV genes into a cell infected with the Δ E3L mutant virus that includes a mechanism for selection of recombinant virus. Our strategy was validated in a recent experiment in which HF were infected with a mixture of Vaccinia virus at 1:10⁷ of wild type : Δ GE3L mutant. The resulting virus was highly enriched for the wild type virus as evidenced by observed cytopathic effect. These results suggest that our strategy provides a sensitive method for identifying the HCMV gene that is responsible for complementation of the Δ GE3L mutant, which we also expect will prove to be important in HCMV pathogenesis.

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PATTERNED HYDROPHOBIC SURFACES IN MICROFLUIDIC DEVICES

JEFF HENDERSON, Pre-Engineering, Freshman
CHARLES V. ROGERS, Pre-Engineering, Freshman
Yael HANEIN, *Electrical Engineering*

We researched the integration of patterned hydrophobic material on Silicon wafer substrates into microfluidic devices. These hydrophobic surfaces, which are water repelling, were utilized to control the flow of water in the device. Microfluidic devices were created with a photolithographic process of patterning micro-sized channels onto a Silicon wafer using a mask that was designed on a computer. A flexible polymer, PDMS (polydimethylsiloxane), was poured over the patterned wafer to create the physical device. Hydrophobic surfaces were patterned on the silicon wafer substrate through similar means by using photolithography with positive photoresist and liftoff process. With the designated hydrophobic areas now patterned in gold, the wafers were subjected to a solution of SAMS (self-assembled monolayers), which turns these areas hydrophobic. Applications of hydrophobic material were investigated relating to “wall-less” channels, valves, pressure sensor and various control designs for microfluidic devices.

SUSTAINABILITY IN SEATTLE

EMILY HICKS, Community and Environmental Planning and Interdisciplinary Visual Arts, Senior
DONALD MILLER, *Urban Planning*

In October of 2001, Seattle held its first public conference on sustainability organized by the local non-profit organization *Co-Opportunities Northwest*. I was fortunate to work with a *Community and Environmental Planning* alumna in preparing an assessment of sustainability with the help of the City of Seattle’s recently formed *Office of Sustainability and Environment*. This report included assessing the state, pressures and response of several organizations and programs dealing with sustainability. This winter quarter I developed further research that involved examining local businesses, organizations and government programs promoting sustainable practices. The research was compiled into a 20 page report and a comprehensive brochure that was distributed in some of the Seattle public libraries. This project focuses specifically on sustainable resources available to the public in our local area with an emphasis on improving our built environments, including issues of energy use, water use, waste management, and the health affects of indoor atmospheres. The conclusion of this project was the discovery that the Seattle area has a wealth of resources that are not being fully utilized due to lack of communication, education, and general awareness of the issue in our community.

A ROLE FOR THE YUCCA FAMILY OF FLAVIN-MONOOXYGENASE GENE IN ARABIDOPSIS INFLORESCENCE DEVELOPMENT

EMI HILL, Cellular and Molecular Biology, Senior
MARIA MALZONE, *Genome Sciences*

The plant hormone auxin has been known for over a century to regulate multiple aspects of plant growth and development. However, the mechanism of auxin biosynthesis and the *in vivo* consequences of auxin overproduction remained elusive until very recently, when the *Arabidopsis* dominant mutant, *yucca*, that overexpresses a flavin monooxygenase-like enzyme was shown to elevate *in vivo* levels of auxin (Zhao et al. 2001, *Science* **291**:306-309). A large-scale activation tagging genetic screen was conducted in *Arabidopsis* with the aim of identifying novel loci that interact with the *ERECTA* locus, whose loss-of-function mutation leads to a characteristic, clustered inflorescence and short internodes. One dominant mutant, *may2-D*, was isolated as a suppressor of a partial loss-of-function allele *erecta-103*. In addition, *may2-D* plants show elongated hypocotyls and stems, epinastic leaves, and reduced

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apical dominance, all of which are characteristic of increased levels of auxin. We cloned the *MAY2-D* gene by inverse-PCR and found that it encodes *YUCCA5*, a novel member of the *YUCCA* family of flavin monooxygenases. Our genetic analyses of *MAY2-D/YUCCA5* and *ERECTA* show largely additive effects on inflorescence architecture with a more-complex interaction specifying the length of pedicels and carpels. We conclude that *YUCCA5* acts largely independently from the *ERECTA* pathway, with possible interplay during the development of specific organs.

ARCHAEOLOGICAL ACOUSTICS: RECONSTRUCTION OF THE IYNX

JESSIE HIRSCH, Physics, Senior
VLADIMIR CHALOUKKA, Physics

The purpose of this project is to develop a mathematical and physical model of an instrument called the iynx. The iynx is mentioned in ancient Greek literature and depicted on Greek vases, but there are no surviving specimens. The iynx is described as a disc or hollow sphere which may be whirled on a cord, spun between the hands on a cord loop, or spun like a top. It was noted for its compelling and intense sonority, hence its use in ancient rituals. The instrument was named after the iynx bird, also known as the wryneck torquilla, and its sound was purported to resemble the cry of this bird. This similarity has been taken into account while designing the acoustic properties of the instrument, which will be spherical. This is a report on work in progress, including review of available information on iynxes, and discussion of the acoustical properties of Helmholtz resonators. The long term goal is to actually machine and test a reconstructed iynx; to our knowledge, this has not been done before.

LOW IMPACT DEVELOPMENT: A BRIEF INTRODUCTION

ROBERT HOLLER, Community and Environmental Planning, Senior
CHRISTOPHER CAMPBELL, Community and Environmental Planning

This project examines Low Impact Development (LID) techniques in order to understand how and if they will be a major part of urban planning in the future. LID can be used to protect the environment, reduce costs and make our communities more attractive, using vegetation and small-scale hydrolic controls to capture, treat and infiltrate storm water on site, rather than collecting storm water runoff through pipes and other drainage systems. What types of LID techniques can be used by the common homeowner, versus those better suited to larger corporations? What is the real difference when LID techniques are applied? How can we provide incentive to spread the use of Low Impact Development? In a time of concern over water shortages, rising infrastructure costs, pollution, and environmental problems, LID may offer up some cost effective, exciting, and innovative solutions.

EXAMINING THE RELATIONSHIP BETWEEN EARLY MALTREATMENT, RELIGIOSITY, AND VIOLENT BEHAVIORS IN ADOLESCENCE

JENNIFER HOLMES, Social Welfare, Junior
TODD HERRENKOHL, Social Work
EMIKO TAJIMA, Social Work

Research has shown that children who have been maltreated are at an increased risk of participating in behaviors during adolescence that may be harmful to themselves and/or others. This project uses an existing data set to examine the relationship between early maltreatment and later resiliency and violence in adolescence. The Lehigh Longitudinal Study is a prospective study of children and families that began in the 1970's. This study collected data from several sources at three developmental stages: preschool, school age, and adolescence. This study examines resiliency factors in children who have been severely physically maltreated. My study will focus on the

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relationship between religiosity and participation in violent behaviors as well as the relationship between religion, violent attitudes and peer influences. I hypothesize that religion provides a network of support that deter maltreated children from engaging in violent behaviors. Results from this study should not only raise awareness about the developmental impact of child maltreatment but also increase knowledge about necessary intervention and prevention that are necessary in developing policies and programs that assist maltreated children in leading healthy and happy lives.

ABILITY OF *ICHTHYOPHONUS HOFERI*, DEVELOPING AND CLEAR SPORES, TO INFECT *LEPTOCOTTUS ARMATUS*, AND INFECTIVE DOSES IN *ENOPHRYS BISON*

AARON HOLMES, Cellular Biology, Senior, MARY GATES SCHOLAR

PAUL HERSHBERGER, *Aquatic and Fisheries Sciences*

RICHARD KOCAN, *Aquatic and Fisheries Sciences*

Ichthyophonus hoferi is a protist fish parasite first documented in 1893. It has since proven to infect a large number of fish species. The detrimental effects on the host impact the seafood industry (McVicar 1999; Patterson 1996; Spanggaard et al. 1994). The goals of the study were to test (1) the infectious potential of two of the organism's life stages in *L. armatus* and (2) to examine four infective doses in *E. bison*. The clear spore life stage proved to be infective, and results indicate a minimum dose amount of less than 1,230 spores per gram body mass (/gBM) in both experiments. These findings may aid in future experimental design possibly illuminating the search for currently unknown transmission routes of *I. Hoferi*.

INVESTIGATING COURSE WEBSITES

SOMALY HOY, Business Administration, Senior

KIMBERLY GUSTAFSON *Program for Educational Transformation Through Technology*

SCOTT MACKLIN, *Program for Educational Transformation Through Technology*

Instructors' use of a course website is becoming an increasingly prevalent tool in higher education. Content of these websites range from simple, single page, text only site designs to more complex sites with links, graphics, interactive features and other web tools; however all are designed to supplement course work and enhance the student's learning experience. Research in this area has primarily looked at specific components of course websites and offer the benefits students might receive if they were to use these tools. However, there is a gap in identifying what students are actually using and more importantly how they are being applied. The aim of this study is to identify the components of course websites that students are utilizing and explore the ways in which these components are being used to help students reach their course objectives. Implementing a qualitative approach, data will be collected primarily through 2-3 focus groups of 6-8 University of Washington undergraduate students. The focus groups will serve as an exploratory tool to identify and assess website components currently being used, as well as tools that could be used. It is the intent of this study to help shape the design of future websites by providing research-based information on what components students say they are using and how they are being used. Instructors and other site designers can then be guided as to what content should be included on course websites that students will utilize in enhancing their ability to reach course objectives.

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MINIMIZING TRANSDUCER HEATING DURING FOCUSED ULTRASOUND SURGERY

GRACE HUYNH, Bioengineering, Senior, MARY GATES SCHOLAR
SHAHRAM VAEZY, Bioengineering

High Intensity Focused Ultrasound (HIFU) can be used as a safe, non-invasive modality for tumor ablation. However, after less than five minutes of treatment, the transducer temperature can increase by $20^{\circ} \pm 4^{\circ}\text{C}$, necessitating that treatment be stopped to prevent thermal tissue damage near the transducer. Minimizing transducer heating ensures device safety and allows for prolonged treatment time because the temperature increases more slowly. Additionally, transducer reliability increases because lower temperatures do not induce irreversible changes in the transducer. Transducer heating can be minimized by optimizing transducer material and by using a water circulation system. Material properties were investigated to minimize the transducer's total attenuation, a value that quantifies how much energy the transducer absorbs and converts to heat. Two main factors contribute to the total attenuation, the material's attenuation coefficient and the lens thickness. Although the attenuation coefficient is measured directly, the lens thickness must be calculated from the speed of sound. These parameters were determined by measuring the peak to peak amplitude and the time delay of the received signal at 3, 3.5 and 4 MHz for two different acoustic paths, one containing the material and the other containing only water. The optimal materials include Lexan, Ultem, and Aluminum. These materials have the lowest attenuation coefficients, averaging 0.76 ± 0.24 Np/cm, and a high average speed of sound of 3520 ± 1000 m/s. This results in an attenuation loss of 0.38 for a lens of diameter 3.81cm and focal length 5.7 cm. To provide further cooling, a water circulation system was designed to cool the transducer via heat convection across the lens surface. Room temperature water is pumped across the lens surface at a rate of 1 mL/sec. Two pumps separately control the inflow and outflow. The temperature response of the transducer in this optimized setup is presented.

UNDERSTANDING EVOLUTION FROM COMPARATIVE COMPUTATIONAL GENOMICS

MICHAEL INOUE, Biochemistry and Economics, Junior, MARY GATES SCHOLAR
RAM SAMUDRALA, Microbiology

The Neo-Darwinian paradigm holds that mutations arise without regard to an organism's biological needs. This is difficult to ascertain since the genes and proteins we generally observe are the products of evolution after natural selection. The goal of this project is to understand the nature of mutations prior to natural selection by analyzing sets of genomes. To accomplish this, we examine amino acid pair frequencies of "normal" genes (genes under selective pressure), pseudo genes (nonfunctional genes free of selective pressure), and "random" genes (for this, we use protein sequences generated using a uniform distribution of nucleotides). We compute six correlation coefficients: a correlation coefficient between each of the above three pair frequencies and a database representing a universe of proteins, and a correlation coefficient between each of the above three pair frequencies and a database representing protein functional sites. These results are then tested to determine their likelihood of arising by chance. Upon initial testing, the amino acid pair frequencies distribution of pseudo genes in the fungal genome set appeared more like a functional distribution than the pair frequencies distribution of normal genes. This indicated that pseudo genes were mutating at a more functional rate than normal genes, possibly implying a molecular mechanism that functionally mutates these pseudo genes in fungi. Upon further analysis, it was shown that there was a distinct possibility these results could have arisen by chance. Further research includes determining which species was inflating this correlation in fungi, and exploring different releases of the original genome sets to see if our analysis holds up to further scrutiny. In addition, the correlation between randomly generated sequences and normal genes was surprisingly high, suggesting that the genetic code is highly optimized to produce "protein-like" sequences and that a different, randomly generated genetic code could produce more "functional" distributions.

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INTEGRATION OF ACOUSTIC AND CHEMICAL PROCESSING

LOUISA IP, Electrical Engineering, Senior

DENISE WILSON, *Electrical Engineering*

While acoustic signal processing and chemical analytical sensor arrays have been the focus of intensive research, little attention has been focused on the integration of acoustic and chemical processing. Sound recognition or chemical sensing alone requires complex algorithms and system models that often fail to provide desired robustness of design. This research provides proof-of-concept of the signal processing and power consumption benefits provided by combining the two senses of hearing and smell as applied to environmental monitoring applications. The signal processing realization of the proposed research will be demonstrated by detection of hazardous chemical leaks in pipelines, detection of exhaust levels from different vehicle types, and detection of breath alcohol levels. Common software and technologies in both signal processing and chemical sensing, such as the Hidden Markov Model (HMM), chemical sensor arrays, and principal component analysis (PCA) will be discussed and applied. Finally, this research project will emphasize the usefulness of integration of "hear" and "smell" and demonstrate that "hear" can enhance "smell" and vice versa based on real world data. The undergraduate research portion of this overall research focuses on the demonstration in software simulation that "hear" combined with "smell" can effectively improve the accuracy of "stimulus" recognition in the three representative applications listed above.

EDUCATION LEGISLATION

ELIZABETH JASPERSON, Political Science, Senior

MARI-FRANCES REINHOLT, Political Science, Senior

BRYAN JONES, *Political Science*

With the election of President Bush there has been a shift in policy ideas on education. The new view Bush has proposed has focused the public's attention on education. The question that we are going to address is what and how outside influences affect the passage of education legislation in Congress. We will be investigating literacy rates, elementary, secondary, and college school enrollments, party control of Congress, election years and various social movements in the United States. Our goal is to determine whether political influences or social influences have greater effect on education legislation. With this information we will better understand when and how to introduce education legislation that will have a greater probability of being passed in Congress. The dependent variable for this study is the passage of education legislation by Congress after World War II. This will be measured by the number of education bills passed in Congress each year. Our independent variables for this study are social statistics and political factors. We will be measuring New York Times articles, statistics on literacy rates, school enrollment, social movements, election years, and party control of Congress. All of our research is obtained from the Policy Agendas Project at the University of Washington and the United States Department of Education. With these combined factors we will conduct a statistical analysis to determine the influences the independent variables have on education legislation. We hypothesize that the independent variables will have no effect on the number of education bills enacted by Congress.

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PLASMA FAN

NELS JEWELL-LARSEN, Electrical Engineering, Junior, MARY GATES SCHOLAR
ALEXANDER MAMISHEV, *Electrical Engineering*

A novel method of micro cooling, utilizing the integration of electrostatic/plasma air pump technology into high density chip structures, is investigated in this experiment. Parallel surface pairs of a carbon doped semi-conductive polyamide are used in conjunction with a high carbon content steel razor to create a plasma air pump with useful operation from 5-8 kV. Wind generation studies are done in ambient conditions, and analyzed using piezoelectric airflow sensors. In addition, computer simulations using Ansoft's Maxwell EM are exploited for optimization of electrode geometries as well as calculating electric fields, and columbic forces within an active device. Electrode erosion and debris accumulation is analyzed using optical and scanning electron microscopy. Preliminary wind generation studies indicate high efficiency air movement, 2-8 times greater than current conventional electric fans, dynamic airflow profiles, and near silent operation.

THE (6-4) PHOTOPRODUCT

LISA JONES, Chemistry and Biochemistry, Senior, MARY GATES SCHOLAR
NATIA FRANK, *Chemistry*

The (6-4) photoproduct is formed in DNA when it is irradiated with UV light. This lesion is believed to be highly carcinogenic. The formation and its repair processes are, however, poorly understood. It is believed that the lesion is formed through an oxetane intermediate. There is however no evidence that this is the case. In order to trap the intermediate a methylated analogue was synthesized. It is proposed that if one methylated the 3 N position of thymidine, one could prevent the intermediate from falling apart to the (6-4) photoproduct and trap out the oxetane intermediate. Once a sufficient amount of modified nucleotide is synthesized irradiation studies will begin that will hopefully determine the intermediate in (6-4) photoproduct formation.

AN ALGINATE-BASED SCAFFOLD CONTAINING AMINO ACID NETWORKS DISPLAYS IMPROVED BIOCOMPATIBILITY *IN VIVO*

RUCHI KAPOOR, Bioengineering and Neurobiology, Junior, MARY GATES SCHOLAR
THEMIS KYRIAKIDES, *Biochemistry*

Implanted biomaterials elicit a chronic inflammatory response that leads to their encapsulation by a poorly vascularized collagenous capsule. This is known as the foreign body response (FBR) and can lead to implant failure. In an attempt to create more biocompatible materials that have a reduced inflammatory response, alginic acid was cross-linked with glycine and lysine and made porous (10-50 μm pore diameter). Following subcutaneous implantation for 4 weeks, the implants were excised en bloc, fixed in formalin and embedded in paraffin. Histological and immunohistochemical analysis of sections indicated significantly reduced capsule thickness in comparison to a similarly cross-linked biomaterial made of poly vinyl alcohol. Within the interstices of the alginate scaffold, we observed the presence of foreign body giant cells, numerous blood vessels, and the deposition of mature collagen fibers. In conclusion, this modified alginate biomaterial elicits a reduced FBR and promotes formation of blood vessels and matrix deposition. These characteristics make this biomaterial an excellent candidate for tissue engineering applications.

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CUBA: COMING TO TERMS WITH CHANGE

GRETCHEN KIEFER, International Studies and Political Science, Senior
FRED ZIMMERMAN, Health Services

My research objective is to explain why income disparity is increasing in Cuba since the collapse of the Soviet Union. My hypothesis is that income inequality is escalating because of the emphasis on tourism (tourism is the number one source of income in Cuba, having surpassed the timeless sugar industry in 1999), with employees in the tourist industry receiving incomes considerably higher than employees in other sectors of the economy. While there are three legitimate currencies in Cuba (the United States dollar the use of which was legalized in 1993, the convertible Cuban peso, and the unofficial Cuban peso currency), US dollars are the dominant and most desirable currency. Cubans who have access to dollars through employment in the tourist industry are emerging as the wealthy class, while those who do not have access to dollars are largely being left behind. The research was done during a two-month visit to Cuba during the summer of 2001.

SELECTIVE PROTEIN SCREENING USING SIZE-EXCLUSION CHROMATOGRAPHY AND DYNAMIC SURFACE TENSION DETECTION

JANE KIM, Biochemistry, Sophomore, MARY GATES SCHOLAR, SPACE GRANT SCHOLAR
ROBERT SYNOVEC, Chemistry

The goal of this project is to couple size-exclusion chromatography (SEC) with the dynamic surface tension detector (DSTD), so proteins can be analyzed selectively. SEC separates proteins based on their molecular size. A size-exclusion stationary phase has pores covering the phase surface. When proteins go through a column filled with this stationary phase, the larger proteins (greater molecular weight) go through quickly due to spending less time in the pores, whereas the smaller proteins spend more time in the pores, thus requiring more time to travel through the column. The DSTD measures the changing pressure of drops across the air-liquid interface that form at the end of a sensing capillary. The sensitivity and selectivity of the DSTD signal is associated with the surface active analyte concentration in solution, in combination with the thermodynamics and kinetics of analyte interaction at the drop air-liquid interface. Proteins interact uniquely at the air-liquid interface dependent upon the pH of study. Significant changes have been observed around physiological pH as the system is tuned from acidic to basic conditions. However, a mixture of proteins is difficult to analyze using only the DSTD. SEC provides some separation of the proteins so the DSTD can be used to selectively analyze for the separated proteins of interest. Complete resolution is difficult to achieve for proteins in a small range of molecular weight. Overlapping peaks that may not be effectively analyzed with an UV absorbance detector may now be selectively analyzed with the DSTD using post-column pH adjustment chemistry. This study consists of initial set-up of the system, which includes coupling of the instrumentation and preliminary results.

POSTER SESSION

PERCEPTIONS OF ITALY: A PHOTOGRAPHIC JOURNEY

MORGAN KIMBROUGH-STRUSS, Community and Environmental Planning, Senior
CHRISTOPHER CAMPBELL, *Community and Environmental Planning*

Fall quarter I traveled to Italy to participate in the Italian Hill Town Program. At the end of my stay in Italy (September to December) I had taken about 40 rolls of film, processed each of the rolls of film on my own while in Italy and scanned the negatives to produce about 20 final images for a presentation to the rest of my class. My resources were small so what I had intended to produce was much smaller than was originally planned. I have been given another opportunity to produce the project that I had originally intended, this time as my senior project in Community and Environmental Planning. I am going to take all of my original photos and select 30 images to be produced for the final product (7 of which will be matted and framed and the other 23 will be placed in a portfolio). Along with each image will be a quote to illustrate the photo; this may be a perception provided by an author or poet of a particular space, it might be from an architect describing the technical intentions of a design, or it might even be a juxtaposition of the two. The quotes are being selected from novels, poetry, travel journals, old letters, biographies, assorted architectural selections, and whatever else I might stumble across. The final result of my project is to show the variety of perceptions that can be interpreted in Italy through different time periods and by a variation of backgrounds.

A METHOD FOR PRESERVING AND RECONSTITUTING BIOLOGICAL REAGENTS FOR MINIATURIZED CLINICAL DIAGNOSTICS

JARED KIRKHAM, Bioengineering, Junior
PAUL YAGER, *Bioengineering*

Miniaturization is a common technological trend. We have seen it with computers and we will soon see it to a large extent with biomedical instrumentation. Currently, medical diagnostic equipment fills large medical laboratories. However, through the use of burgeoning microfluidic and micromachining technology, this equipment may soon become integrated on a wafer the size of a credit card. Such miniaturized devices have colloquially been termed "lab-on-a-chip" devices. Although these devices are in their infancy, they have many potential benefits. For example, they may move medical testing from a central lab to a patient's bedside, they reduce costs while increasing the speed and accuracy of medical testing, and they may help to broaden the geographical reach of medical care. Although the potential applications are very promising, lab-on-a-chip technology faces many challenges. For example, in the ideal case, these portable devices would include all of the reagents necessary to perform the biological tests, and may be stored before they are used. Consequently, there must be a way to preserve and later reconstitute biological reagents within these devices with minimal loss of biological activity. As a preliminary solution to this problem, it is proposed that the biological reagents be dispersed within a glass-state matrix of the sugar trehalose and stored within cavities in the device. Subsequent reconstitution with liquid produces a sustained release plume of reagent downstream for use in the necessary assay. Further investigation is needed to ensure the functionality and reproducibility of this method.

POSTER SESSION

TRAUMA NARRATIVE STRUCTURE AND POSTTRAUMATIC STRESS DISORDER

KATIE KLEIN, Psychology, Senior
LORI ZOELLNER, Psychology

Both anger and guilt are predictors of post-trauma psychopathology (e.g., Brewin, Andrews, & Rose, 2000; Kubany et al. 1995). Indeed, it has been hypothesized that anger and guilt may impair emotional processing after a traumatic event (Foa et al., 1995; Brewin et al., 1996). According to Hembree and Foa (2000), trauma narrative organization may be critical for processing trauma, with unorganized trauma narratives indicating disturbances in emotional processing. Harvey and Bryant (1999) found that trauma narratives of individuals with ASD from motor vehicle accidents were more disorganized than narratives of individuals without ASD. No study, to date, has directly compared the organization of trauma narratives between individuals with and without chronic PTSD. In the present study, female assault survivors with and without chronic PTSD are asked to recount in detail their traumatic experience as well as a routine, neutral event. Participants are also asked to report state anger, guilt, and anxiety, while recounting these events. We hypothesized that trauma-exposed individuals with PTSD will have trauma narratives that reflect higher levels of guilt, anger, and disorganization than individuals without PTSD. These narratives will be analyzed using a qualitative analysis program called NUD.IST (Non-numerical Unstructured Data Indexing Searching and Theorizing System) for indicators of emotional processing. Further, we will examine statements regarding self-evaluation and self-involvement. This study may provide further insight into narrative factors that differentiate individuals who show natural recovery after a trauma and those who do not.

NEURONAL CONTROL OF WING MOTION IN INSECT FLIGHT

KATARZYNA KODZISZEWSKA, Neurobiology and Cellular and Molecular Biology, Junior, MARY GATES SCHOLAR
THOMAS DANIEL, Zoology
MICHAEL TU, Zoology

Neuronal control of insect flight, like movement control of any creature, involves a complex interplay between sensory information and motor coordination. The role of the nervous system in regulating this action as well as the correlations between muscle activity, wing stroke trajectory, and aerodynamic forces acting on the body are essential for understanding of these processes. My research focuses on the interactions of different muscles involved in flight control, their patterns of activity and their influence on wing motions. I use extracellular electrodes in various muscles of a giant hawk moth *Manduca sexta* to assess muscle activity during free flight. I also use a high-speed videography to record wing movements. At the same time I acquire extracellular recordings from two distinct types of muscles that, I think, play different roles during insect flight. One of them (the dorsal lateral muscle) powers the wing stroke, while the other (the basalar muscle) controls the animal trajectory. The patterns generated by these two muscles are linked by a phase-shift mechanism. The concepts of movement control obtained from studying this model organism can be potentially applied to a wide range of organisms and contribute to a better understanding of motion in general.

POSTER SESSION

IDENTIFICATION AND CHARACTERIZATION OF NOVEL GENETIC COMPONENTS OF ECDYSIS IN *DROSOPHILA*

GLORIA KUO, Biology and Psychology, Senior
CHRISTINA TAKANISHI, Biology, Junior
SUSAN MCNABB, Zoology

Insect ecdysis results in the shedding of the cuticle to complete the molting process. This behavior is essential for the life history of all insects. We have been focusing on the final ecdysis termed eclosion, which results in adult emergence. Recent discoveries suggest that a complex regulatory network underlies this behavior. We are using a genetic approach to identify novel regulatory elements. The neuropeptide eclosion hormone (EH) is an important regulator of insect ecdysis. *Drosophila* strains that lack EH or are defective in bursicon regulation share visible characteristics of poor cuticle tanning and failed or partial wing inflation. Using these phenotypes as indicators, we performed a genetic screen for additional mutants with eclosion defects. We further characterized the strains of interest from the screen through a combination of immunocytochemical, genetic, and behavioral techniques. So far, we have identified 16 new mutations corresponding to four complementation groups. Although these studies are still in progress, our data suggests that at least three complementation groups are regulators of eclosion. In the future, we plan to molecularly identify the protein product of the mutated genes.

SEARCHING THE WEB FOR CONSUMER HEALTH INFORMATION

PHUONG-UY A. LAM, Applied Computational and Mathematical Sciences, Junior
EFTHIMIS N. EFTHIMIADIS, Informatics

The question raised in the research explores the process of how people search to find answers to questions using on-line searching tools. This problem differs from past Web searching behavior research in that people have to find specific information that provides answers to a particular topic. Investigating this problem will help us to better understand people's cognitive processes and decisions made during the search. This will enable us to see how current search engines can be improved to better assist their users. Data is collected by a field study where subjects are asked to find answers to four questions in the consumer health information area. To keep track of their searching process, we ask them to think aloud and explain their steps as they search. In addition, an application, Camtasia, is used to record all the activities taking place on the monitor. Thus, we are able to see where they are going on the Web and understand why they went to that particular website. Subjects are asked to answer a pre-questionnaire that collects demographic and other related information about their educational background and experience doing searches. A questionnaire after each search measures the subject's satisfaction with the search result and elicits information on difficulties they might have encountered in the search process. We are currently analyzing data. During the poster presentation, we will be able to present the analysis of the data collected. The questions we ask users include: search experiences, educational background, knowledge of subject, trust and reliability of websites offering information and searcher satisfaction. Findings at the end of this research project will help develop a model of how searchers look for consumer health information on the Web as well as suggesting a list of improvements to the design of search systems.

POSTER SESSION

PROCESSING AND CHARACTERIZATION OF HYDROXYAPATITE COATINGS

CORY LARSEN, Metallurgical Engineering, Senior
RAJ BORDIA, Materials Science and Engineering
TOM TROCZYNSKI, University of British Columbia

When a foreign object is placed in the human body there are two possible outcomes: the first is that the body accepts it and everything goes all right, and the second is that the body rejects the foreign object causing infection or more surgeries to replace or remove the object. One way to help the body accept foreign objects is to coat them with Hydroxyapatite coatings. Hydroxyapatite ($\text{Ca}_{10}(\text{PO}_4)_6\text{OH}_2$) is the closest thing that scientist and engineers have come in creating synthetic bone. In the last 10 years the Sol-Gel process has gained much attention over other methods of applying HA. One of the main benefits of the Sol-Gel process is relatively easy to use because of its low temperature requirements and coating methods. For this project, the process of making the Sol-gel will be the same process used by Dr. Troczynski (at the University of British Columbia), and the main goal of this project will be to look at what types of surface treatments are needed to have a uniform crack free coating. After the Sol is prepared, the use of sandblasting, sandpaper and chemical enchants will be used to prepare the surfaces of the substrates.

PRIVACY RIGHTS

RACHEL LEIGH, Law, Societies and Justice and Sociology, Senior
BRYAN JONES, Political Science
HEATHER LARSEN, Political Science

What influences public policy changes in privacy rights? That is, what factors are causing positive feedback in the punctuated equilibrium process? This question is *important* because many public policies (categorized as areas of privacy) affect our most basic activities in our everyday lives. The six areas of privacy rights I am examining include: law enforcement, the self, the press, the voyeur, the workplace, and information. First, I hypothesize that as attention to issues of privacy increases within the public, attention to privacy issues increases within Congress. Secondly, I hypothesize that due to recent innovations in information technology the greatest change in all six areas of privacy rights will be in the area of *privacy and information*. Lastly, I hypothesize that the least amount of change in the six areas of privacy rights will be in the area of *privacy versus the press*. I plan to conduct a statistical analysis for privacy in general, and then conduct case studies for two specific areas of privacy, *the self* and *the press*. I will use a regression analysis for Congressional hearings and New York Times articles from post-WWII-1994, supplemented by Congressional Quarterly stories and factual cases to illustrate public policy changes. I will use data from the Policy Agendas Project at the University of Washington. I expect to find that overall in the six areas of privacy rights positive feedback occurs when public attention is heightened through coverage of privacy rights areas in Congressional hearings and New York Times articles. The most amount of change should occur in the area of *privacy and information* and the least amount of change should occur in *privacy versus the press*.

POSTER SESSION

THE EFFECTS OF GALANIN-LIKE PEPTIDE (GALP) ON FEEDING AND BODY WEIGHT

SOLEIL LEILABADI, Biochemistry, Senior
ROBERT STEINER, *Obstetrics and Gynecology*
DON CLIFTON, *Obstetrics and Gynecology*

Galanin-like peptide (GALP) is a neuropeptide that shares some amino acid similarity with galanin. Previous experiments in our lab have shown that the expression of GALP mRNA in the hypothalamus is increased by leptin, a hormone that decreases food intake (FI) and body weight (BW). We hypothesized that GALP plays an intermediary role in leptin's effects on feeding and body weight and thus should have similar effects as leptin. In our first study, mice received either an intracerebroventricular injection of vehicle or GALP (5nmol) twice daily for 5 days. FI and BW were lower in GALP treated mice after 24 hours but within 48 hours FI recovered even though GALP injections continued. The second study was to determine the effects of different doses of GALP on FI and BW. The mice received two injections of 0, 1, 5, or 10 nmol GALP 14 hours apart. After the first 24 hours FI decreased and BW was suppressed by the 5 and 10 nmol doses of GALP. We also wanted to determine whether the decrease in FI and BW following GALP treatment is a consequence of illness. We tested this with a conditioned taste aversion test, in which mice were exposed to saccharin water and then immediately afterwards injected with vehicle or GALP. If GALP makes the mice feel sick, they will associate feeling ill with the saccharin and will avoid saccharin in the future. The GALP-treated mice did form an aversion since they drank significantly less saccharin water than the vehicle-treated mice. This suggests that GALP might make mice sick; however, further studies need to be done to confirm this conclusion.

THE EFFECT OF GROWTH HORMONE ON THE EXPRESSION OF GALANIN-LIKE PEPTIDE MRNA

DOROTHY LI, Neurobiology and Biochemistry, Senior, MARY GATES SCHOLAR, HOWARD HUGHES SCHOLAR
ROBERT STEINER, *Physiology, Biophysics, Obstetrics, and Gynecology*

Galanin-like peptide (GALP) is a newly discovered neuropeptide that shares a partial sequence homology with the peptide galanin. In the rat, GALP mRNA levels are regulated by metabolic factors such as fasting and leptin (a hormone secreted by adipocytes). However the exact role of GALP is still unclear. An initial study has shown that the expression of GALP mRNA is significantly lower in hypophysectomized (hypox) rats compared to intact animals, suggesting that the pituitary may have an effect on the expression of GALP. We hypothesized that the reduction in the expression of GALP mRNA in the hypox animals was due to the absence of growth hormone (GH). Sham vehicle, hypox vehicle, and hypox rats supplemented with GH via osmotic minipump were given free access to water and food. Body weight and food and water intake were measured daily over a 7 day period. The hypox group had significantly lower body weight and food intake compared to the sham vehicle group. In the GH-treated hypox group, there was a significant increase of food intake and body weight compared to the vehicle hypox group. However, the body weight and food intake in the GH-treated animals was still significantly lower than that of the sham vehicle group. Insulin-like growth factor-1 (IGF-1) levels in the GH-treated hypox group were significantly higher than in the hypox vehicle group, but still lower than in the sham control animals. To determine whether GH-treatment caused an increase in GALP mRNA expression, we performed quantitative *in situ* hybridization for GALP mRNA in hypox vehicle and GH-treated hypox animals. The data for this experiment is still being analyzed. The effect of GH-treatment on the expression of GALP mRNA in hypox rats remains to be seen.

POSTER SESSION

A NOVEL WAY TO CONTROL MICROCELLULAR FOAM DENSITY USING DESORPTION TIME

LIANNE LIN, Bioengineering and Biochemistry, Senior, MARY GATES SCHOLAR
VIPIN KUMAR, *Mechanical Engineering*
BRIAN FLINN, *Material Science Engineering*

Current research knowledge in biomaterials supports the utilization of porous biodegradable polymer matrices for tissue engineering and guided tissue regeneration. Microcellular polymeric foams, characterized by bubbles with diameters ranging from 10 - 100 micrometers, are porous materials that have great potential for biomaterial applications. The simplest way to produce microcellular foams is with the batch mode microcellular process. Factors that affect the final foam density in this process include saturation pressure, foaming temperature, and desorption time. The dependence of foam density on saturation pressure and foaming temperature has been well documented in microcellular foam literature. However, recent results in continuous mode microcellular process have shown that desorption time can also be a major factor in controlling foam density. This study investigates the effect desorption time has on foam density in the batch process for the following polymers: ABS, CPET, and PC. Relative density of ABS increased from 30% to 90% during the first six days of desorption, while CPET went from 60% to 90% in the first day, and 67% to 99% in the first 18 hours of desorption for PC. These results have indicated that desorption time can, in fact, be used as a variable in controlling foam density. This has provided a novel way to create microcellular foam.

WOMEN: THE ACCIDENTAL POLITICIANS

CARLY LINDBERG, Women Studies, Senior
MARIEKA KLAWITTER, *Evans School of Public Affairs*

The purpose of my thesis is to provide an in-depth study of an obscure practice in the legislative branch of the government. When a male legislator passes away while in office, his wife often fills the vacancy. This practice has occurred since 1923 and continues in present time. Its name is the "Widow's Mandate" and it began on the heels of the Suffrage Movement. There are interesting points that arise with a topic like this. If women were still being considered so incapable of handling the pressures of being involved in politics by so many people, why would they be "allowed" to fill in for their deceased husbands? One would wonder where the experience comes from that instilled confidence in the voters. Should women be grateful to be allowed this opportunity that they might not have had otherwise? Or should they be offended that a man's wife would be the obvious second choice because it was assumed that she would hold the exact same opinions and political views as her husband? My research concentrates on mostly government publications and biographical information. Project goals include documentation of the birth of the tradition of wives replacing their deceased husbands in office, and exploring public opinion regarding this practice through archived newspapers from the 1920's through the present. I will also examine the implications this practice has had on forming public policy.

POSTER SESSION

FIBROBLASTS: THE EFFECT OF CELL SHAPE ON CELL MIGRATION

WILLIAM LITTLE, Bioengineering, Senior
VIOLA VOGEL, Bioengineering

It is known that fibroblasts undergo a change in phenotype after 2-3 days of a cutaneous wound and begin to migrate on a fibrillar matrix containing the glycoprotein fibronectin. To investigate a possible mechanism for this process, we observed the effects of cell shape on fibroblast migration and migration speed in vitro by using micropatterned lanes of adsorbed fibronectin as compared to fibronectin fibrils. The results of this study show that there is no statistically significant correlation between cell shape and migration speed on 2-D micropatterned surfaces. We also investigated whether there was a correlation between cell shape and the percentage of cells that were migrating in a given field of microscopy and found that the percentage of migrating cells was inversely proportional to the thickness of the micropatterned lane upon which they were migrating. This may occur because cells patterned on thinner lanes more readily form cytoskeletal stress fibers that are necessary for cellular migration. The results of our investigation suggest that control of cell shape may be critical for the mass migration of fibroblasts observed during the process of cutaneous wound healing.

INFORMATION ASSURANCE FOR WIRELESS SENSOR NETWORKS

PAUL LIU, Electrical Engineering, Senior, MARY GATES SCHOLAR
RADHA POOVENDRAN, Electrical Engineering

Integrated services for secure wireless communications in which various devices can be networked together and depend on each other is becoming feasible due to the convergence of computing and communications where it is now possible to fabricate an entire System On a Chip (SOC). However, such devices are also limited in energy, storage, computational power and bandwidth. Hence, many of the traditional network and communication methodologies cannot be directly used to develop infrastructure services for such networks. This project will address the security issues raised by the constraint on the types of protocols that can be used.

ISOLATION OF A CONGO RED BINDING MOLECULE FROM AVIRULENT RED MUTANTS OF *MYCOBACTERIUM AVIUM*

DEVON LIVINGSTON-ROSANOFF, Biochemistry and Russian, Senior
GERARD CANGELOSI, Pathobiology

Mycobacterium avium is a water-borne pathogen that is very closely related to *M. tuberculosis*, the bacterial cause of tuberculosis. Individuals who are immunocompromised, such as those suffering from AIDS, are the most susceptible to infection by this bacterium. When grown in media containing the dye Congo red (CR) a phenotypic switch is observed. Some colonies bind the dye (red colonies) whereas others don't (white colonies). The white morphotype is more virulent and drug resistant than the red morphotype. By understanding the molecular basis for CR binding, we hope to gain new insights into how this pathogen causes disease and resists treatment. We have hypothesized that CR binds to one or more cell surface receptors that are either missing or masked in white variants. In order to identify the hypothetical CR receptor(s), we harvested red and white cells grown on agar media containing CR, following a protocol that prevented that minimized cell wall breakage. Surface-exposed molecules released during this process were analyzed by SDS-Polyacrylamide Gel Electrophoresis. We observed a red band in lanes containing the red cell samples, but not in lanes containing the white cell samples, suggesting that this band contains a CR binding site. We are currently using tandem mass spectrometry to identify the CR-binding molecule.

POSTER SESSION

BRIDGING THE GAP: PUGET SOUND AND GEORGIA BASIN ECOSYSTEM

LISA LOCKREM, Community and Environmental Planning, Senior
CHRISTOPHER CAMPBELL, Community and Environmental Planning

The Puget Sound and Georgia Basin ecosystem passes through the boundary between the western United States and Canada. This international setting has spurred many calls for cooperative ecosystem management. Currently, a number of stakeholders have developed their own agendas and action plans. In effect, there are several ideas that could be united for implementation in a collaborative effort thus increasing the amount of energy and overall success of management for the ecosystem. The focus of this project is to analyze the views of stakeholders in the Puget Sound and Georgia Basin ecosystem on what they believe to be the most pertinent management issues for the next ten to fifteen years and the best method for addressing these issues. This analysis is the beginning of a process to bridge the gap in communication amongst the stakeholder groups and help the groups cooperatively develop recommendations for future management of the Puget Sound/Georgia Basin and other transnational ecosystems.

EARLY ULTRASTRUCTURAL CHANGES IN MOUSE ANTEROVENTRAL COCHLEAR NUCLEUS AFTER UNILATERAL COCHLEA REMOVAL

MELISSA LOFGREN, General Studies and Public Health, Senior, HOWARD HUGHES SCHOLAR
EDWIN RUBEL, Virginia Merrill Bloedel Hearing Research Center
LESNICK WESTRUM, Neurological Surgery and Biological Structure

We are interested in identifying the cellular mechanisms by which auditory input influences the development of brainstem auditory nuclei. The cochlear nuclei receive afferent input from the cochlea via VIIIth nerve axons. Afferent innervation supports the survival of neurons in the mouse anteroventral cochlear nucleus (AVCN). During a critical period between postnatal days (P)5 and P14, experimental removal of afferent inputs results in the degeneration of up to 70% of neurons in the AVCN. In this study, we examined ultrastructural changes in AVCN following deafferentation during this critical period. Unilateral cochlea removal was performed in P5 mice. After various survival periods from 3 to 24 hours, mice were perfusion-fixed and processed for conventional transmission electron microscopy. Control tissue shows at least two populations of cells and a few synaptic contacts in varying stages of

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maturation. As early as 6 hours after deafferentation, we observe degeneration of axons, synapses, and neuronal cell bodies within AVCN, and find evidence for both necrosis and apoptosis. These changes are more pronounced by 18 hours after cochlea removal. The data presented herein suggest that AVCN neuron survival depends on the presence of afferents when synapses are still immature. In addition, ultrastructural studies will provide an important tool for examining mechanisms of deafferentation-induced cell loss during the critical period.

PROSPECTS FOR A UNIFIED CYPRUS

CARI LOOMIS, Human Nutrition, Sophomore at Washinton State University
GEOFFREY PEARSON, Biology Education, Junior at Washington State University
WILLIAM SMITH, *Honors College, Washington State University*

The Republic of Cyprus has had 37% of its country illegally occupied by Turkey since 15 July 1974. This has led to the displacement of 200,000 Greek Cypriots from their homes, while those that remained in the Turkish section have faced oppression, harassment, and deprivation. Throughout these years of occupation, the UN Security Council passed 84 Resolutions while the General Assembly passed an additional 12, all addressing the divided nation. Whereas the government of Turkey wants to create a second nation comprised of ethnic Turks on the island, Cyprus believes that both the ethnic Greeks and Turks should be blended into a single nation. The government of Cyprus opened another round of proximate talks with the so-called Turkish Republic of Cyprus in January 2002, but they have not been going well, as there is a lack of acceptable solutions between the two sides. In the unoccupied Cyprus, there is no distinction between the Greek or Turkish Cypriot, but they live and work together in peace. This presentation combines independent research with information gathered from meetings with the Cypriot Ambassador to the UN and the Consul in Seattle in an evaluation of the possibilities of creating a unified Cyprus.

THE ROLE OF SPECIFIC BASIC AMINO ACIDS IN SAA-MEDIATED ARTERIAL WALL LIPID RETENTION: SAA EXPRESSION AND GEL SHIFT ASSAYS

ROLAND LOPEZ, Biochemistry and Psychology, Senior, MARY GATES SCHOLAR
KEVIN O'BRIEN, *Medicine*
TOM MC DONALD, *Medicine*

Serum Amyloid A (SAA), a 102 amino acid protein that is expressed by the liver in response to inflammation, long has been known to be associated with lipoproteins, specifically high-density lipoproteins (HDL). Recent studies have shown that SAA-containing HDLs are retained in atherosclerotic plaques. It is believed that SAA-containing HDL is retained in plaques through ionic interactions between positively-charged SAA amino acids and negatively-charged glycosaminoglycans (GAGs) of arterial wall proteoglycans. Research will focus on determining the specific amino acid residues on SAA that mediate this interaction with proteoglycan GAGs. One potential application of this project would be to design a drug that interferes with this interaction, thereby decreasing lipoprotein retention in developing atherosclerotic plaques. In this project we will determine if SAA RNA and protein are transiently expressed from previously-cloned SAA DNA's (wild type; 3 amino acid mutant, and 6 amino acid mutant) and compare relative binding affinities of the expressed SAA proteins to proteoglycan GAGs. SAA RNA will be detected by the use of Northern blotting and SAA protein will be detected by Western blotting. Affinities will be compared using electrophoretic gel mobility shift assays. Data from transient transfections of human fibroblasts suggests that the plasmids do express both mRNA and protein for murine SAA.

POSTER SESSION

FIRST ROBOTICS

STEPHANIE LU, Electrical Engineering, Sophomore
MARY GATES SCHOLAR

CLIFF OLMSTEAD, Electrical Engineering, Senior
MARY GATES SCHOLAR

BOHAO SHE, Electrical Engineering, Senior
MARY GATES SCHOLAR

KENNETH SHOSTAD, Electrical Engineering, Junior
MARY GATES SCHOLAR

ANNA TONKONOGUI, Pre-Engineering, Sophomore
MARY GATES SCHOLAR

KA CHUN WONG, Electrical Engineering, Sophomore
MARY GATES SCHOLAR

DAVID PEARCY, Mechanical Engineering, Junior
MARY GATES SCHOLAR

ALEXANDER MAMISHEV, *Electrical Engineering*

The FIRST (For Inspiration and Recognition of Science and Technology) Robotics Competition challenges teams of students to design and build a full-size robot in a six-week timeframe. Unlike many other competitions, the rules change every year, and there are strict material and weight restrictions. The 2002 competition, "Zone Zeal," involves manipulating goals, balls and robots, and positioning them in the most advantageous zone at the end of the two-minute match. The robots work in teams, randomly assigned pair against randomly- assigned pair. The timeline of the building process is very demanding. During the first week, the students discuss the competition's rules and debate over the best design for the robot. The next weeks are for prototyping, subsystem design and integration. By week six, the robot is assembled and ready for the driving practice. Of course, there are always bugs to be worked out! This is the third year that the University of Washington has mentored a high school team. Partnered with Roosevelt High School, the team members have appropriately nicknamed themselves S.W.A.T. (Students Working Against Time). 38 students strong, SWAT has perhaps the greatest community outreach among all of the teams in the Pacific Northwest, hosting both the pre-shipping competition for the Northwest teams, and the PNW Regional. Building the robot, however, is only a small part of what the SWAT team members do. Because the project is so multifaceted, the students must get involved in business, management, graphics design, law, communications, web development, programming and computer animation, as well as the expected mechanical, electrical and computer engineering. Being a part of FIRST is frequently described as forming your own startup company. At the end, students go home satisfied that not only had they built a working robot, but also taken part in a project that covers it all.

A PHYLOGENY OF *MANACUS* MANAKINS (AVES: PIPRIDAE) USING NUCLEAR INTRONS

DAVID LUM, Biochemistry, Senior, MARY GATES SCHOLAR, HOWARD HUGHES SCHOLAR,

SCOTT EDWARDS, *Zoology*

ROBB BRUMFIELD, *Zoology*

The piprid genus *Manacus* is composed of four allospecies distinguishable by differences in male plumage color. Previous work by Brumfield and Braun (2001) using protein electrophoretic data has shown each *Manacus* form to be monophyletic, with the exception of *M. manacus*, in which the trans-Andean (west of the Andes) population was sister to *M. vitellinus*, rather than to its conspecific cis-Andean (east of the Andes) population. Here, I used DNA sequences to examine phylogenetic relationships among *Manacus* species. DNA sequence data was obtained for two to nine individuals of each *Manacus* species plus seven outgroup piprids from three nuclear introns (rhodopsin intron 2, beta-fibrinogen intron 7, and beta-actin intron 3) totaling approximately 1.7 kb in length. This data was used to infer the phylogenetic relationship of the taxa. An analysis of one of the three introns supported the monophyly of the genus *Manacus* as well as the groupings of *Antilophila* + *Chiroxiphia* + *Corapipo* and of *P. mentalis* + *P. fasciicauda* + *D. pipra*, consistent with previous phylogenetic analyses of manakins. Among *Manacus* species there was little variation in the intron sequences. Thus, phylogenetic relationships among *Manacus* species were unresolved. Despite the lack of resolution within *Manacus*, this study demonstrates the utility of nuclear introns in resolving

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phylogenetic relationships, at least at the intergeneric level. Because the introns are less variable than mitochondrial sequences, longer intron sequences will be necessary to resolve relationships among closely related taxa, as is the case with *Manacus* species.

CONFIGURING AND CALIBRATING A CTD DEVICE

AMIT MAHTANI, Pre-Engineering, Freshman, MARY GATES SCHOLAR, SPACE GRANT SCHOLAR
PETER RHINES, *Oceanography*
ERIC LINDAHL, *Oceanography*

A CTD device is an instrument that is used to determine the conductivity, temperature, and depth of a given fluid, and can be calibrated to provide measurements of salinity and density of a given fluid as well. Such a device is one of the most useful instruments in oceanography and has many uses inside the laboratory as well as in field study. The purpose of this research was to construct a CTD device that could be used in conjunction with other experiments in a laboratory. Through an unmounted CTD probe we can collect various signals in a fluid, and by transmitting these signals through digital outputs, these signals can be logged back to a computer using an RS232 module and converted into raw data. Software is written for the CTD to translate the raw data produced and interpret these data into real units. Additional software can then be written to account for the measurement of additional variables such as salinity and density. After a lengthy calibration period, we have deemed the device ready for use in a lab-type environment (such as ocean-circulation experiments).

EFFECTS OF MOTION AND CLOSURE ON ECOLOGICAL SYSTEMS

HILLARY MARSHALL, Wildlife Science, Sophomore
EMILY AUGENSTEIN, Environmental Studies, Junior, MARY GATES SCHOLAR
EMILY THOMPSON, Aquatic and Fishery Sciences, Sophomore
FRIEDA TAUB, *Aquatic and Fishery Sciences*

In most freshwater systems, movement and water currents are natural elements. We studied the effects of motion and closure on ecological system development. Three treatment groups were created: (a) stationary open, (b) stationary closed, and (c) rotating closed on a Cell Culture Roller Drum (New Brunswick Scientific Inc.), that rotated once every five minutes. There were a total of 18 flasks, each established with equal amounts of algal medium and five freshwater animals, *Daphnia magna*. One hypothesis was that atmospheric exchange would be beneficial to *Daphnia* survival. Another hypothesis was that motion would produce larger populations due to more efficient feeding and nutrient cycling. For approximately one-month population counts of *Daphnia magna* were taken. Populations increased to a carrying capacity of approximately 25 *Daphnia magna*. The closed systems then demonstrated a sharp decline to a population average of about 6 *Daphnia magna* per flask, while the open system had a more gradual decline to an average of 8 *Daphnia magna* per flask. Chlorophyll, (estimated by plant stress meter measurements), declined. With small differences in the population sizes for both of the closed treatments, one might conclude that algae, rather than motion, was the primary factor determining *Daphnia magna* population sizes in closed ecosystems. Furthermore, since there was little difference in closed and open systems the limiting factor for algae was most likely not a property of atmospheric exchange, but possibly a property of the medium. The results show that movement is not detrimental to *Daphnia magna* populations. Continuation of this experiment may show more differentiation in *Daphnia magna* populations over time.

POSTER SESSION

AFFECTS OF CHANGES IN CELLULAR STRUCTURE

CLINTON MATSON, Cellular and Molecular Biology, Senior
JENNIFER LOERTSCHER, Zoology
ROBIN WRIGHT, Zoology

The general aim of research conducted in the Wright laboratory is to develop a molecular description that defines how cells monitor their need for additional endoplasmic reticulum (ER) membranes to accommodate changing conditions. To this end, we are investigating karmellae, stacks of smooth ER membranes that *Saccharomyces cerevisiae* assemble in response to increased levels of the ER-membrane protein, HMG-CoA reductase, which catalyzes the rate-limiting step in cholesterol biosynthesis. The specific goal of recent investigations is to understand dynamic assembly of karmellae over time and to determine inheritance patterns of cellular organelles in dividing yeast cells. To accomplish this goal we generated a galactose-inducible fluorescent fusion protein consisting of Hmg-CoA reductase and the yellow fluorescent protein (YFP). The resultant fusion protein was targeted to the *S. cerevisiae* genome replacing wild type *HMG1*. Using real-time fluorescence microscopy techniques on a two-photon confocal microscope, this fusion protein enables us to visually follow ER proliferation in four dimensions. This improved understanding of the early stages of karmellae biogenesis and of the temporal relationship between yeast cell budding and karmellae formation, will allow us to test some basic hypotheses pertaining to organelle biogenesis.

SCREEN FOR DOSAGE-DEPENDENT SUPPRESSION OF TEMPERATURE SENSITIVE *SPC29-20* MUTATION IN *S. CEREVISIAE*

MARK McELWAIN, Cellular and Molecular Biology, Junior, MARY GATES SCHOLAR
TRISHA DAVIS, Biochemistry

In mammalian cells, the structure that organizes and stabilizes microtubules, the microtubule organizing center (MTOC), is known as the centrosome. Microtubules are long protein structures that, during cell division, extend from a centrosome on either side of the cell and bind to the chromosomes, creating a bipolar spindle. As the cell finishes dividing, the centrosomes and associated microtubules are pulled to different daughter cells, ensuring accurate segregation of the chromosomal DNA. A protein complex called the spindle pole body (SPB) is the MTOC of yeast. *Spc29p* is a core component of the SPB. In the *Spc29-20* mutant yeast strain, mitosis proceeds correctly at room temperature. At restrictive temperatures, the mutant cells duplicate the SPB but the new SPB disintegrates during mitosis, arresting the cell cycle (Adams and Kilmartin, 1999). In order to better understand the interactions among SPB proteins and other proteins, at least 49 genome equivalents of the *S. cerevisiae* genome were screened to find suppressor genes for the *Spc29-20* mutation. A library of plasmids containing random inserts of genomic DNA were transformed into *Spc29-20* yeast and the transformants were incubated at restrictive temperature. The plasmid DNA was recovered from rescued cells and the suppressing gene was sequenced. These suppressor genes were retransformed into yeast to confirm suppression. Two plasmids have shown suppression, each occurring only once. One plasmid contained both HSP150 and CIS3, and the other contained RSC3. The relationship between SPB duplication and these genes suppressing the *Spc29-20* mutation will be studied in the future.

POSTER SESSION

COMPUTATIONAL TECHNIQUES FOR ANALYZING THE SPATIAL DISTRIBUTION OF ANIMALS

IAN MCFARLAND, Biology: Ecology, Evolution, and Conservation, Senior, HOWARD HUGHES SCHOLAR
JULIA PARRISH, Zoology

In studies of social aggregation behaviors, different indices of aggregation are commonly used to describe or quantify the distribution of individuals. Many such indices are used and reported; however, no standard measure has been developed, making comparison among applications difficult. We studied the relative effectiveness of twelve indices, including the Clark and Evans index, Mean Crowding, and Nearest Neighbor Distance, in detecting the differences in distributions of points which had known properties. These distributions were from two categories: first, varying numbers of points scattered independently over the field; second, a set number of points distributed in groups of varying size and configuration. While each index was sensitive to some configurations, no single index was completely sensitive to all of them. Therefore, the choice of index is an important decision when studying aggregation behavior.

GENE THERAPY FOR DUCHENNE MUSCULAR DYSTROPHY (DMD) WITH ADENO-ASSOCIATED VIRUS-6 EXPRESSING INSULIN-LIKE GROWTH FACTOR-1

TARA MCNAIR, Biochemistry, Senior
JEFFERY CHAMBERLAIN, Neurology
STEPHEN HAUSCHKA, Biochemistry

Duchenne Muscular Dystrophy (DMD) is a lethal muscle disease caused by mutations in the dystrophin gene, and is distinguished by muscle weakness, increased regeneration and degeneration. It has been shown that insulin-like growth factor-1 (*Igf-1*) delivery to muscle can enhance muscle regeneration and prevent age-related declines in muscle mass and function. The goal of this project is to design, construct and test adeno-associated virus-6 (AAV-6) mediated gene transfer to muscle of *Igf-1* under the control of three different promoters. The promoters that will be used are CMV, CK6 and Desmin. These three constructs will be injected into the muscle of mice to measure the effect of *Igf-1* over-expression at different points, post injection. This data will allow us to compare the different promoters, showing when, where and how much *Igf-1* is present in the muscles. We will assess this by looking at muscle fiber diameter, fiber type and contractile properties. At present, the CMV-*Igf-1* and CK6-*Igf-1* vectors have been assembled and they are currently being cloned into AAV vector. The creation of three *Igf-1* constructs is the first step in exploring the possibilities of co-delivering *Igf-1* and micro-dystrophin to develop a gene therapy approach for DMD.

POSTER SESSION

NUTRITIONAL REQUIREMENTS OF AVIRULENT RED VARIANTS OF *MYCOBACTERIUM AVIUM*

ANNELIESE MILLONES, Microbiology, Junior, HOWARD HUGHES SCHOLAR
D. LIVINGSTON-ROSANOFF, Biochemistry and Russian, Senior
GERARD CANGELOSI, Pathobiology

Mycobacterium avium is an environmental pathogen that infects AIDS patients and other susceptible individuals. *M. avium* infections are difficult to treat because of the intrinsic drug resistance of the pathogen. Clinical isolates of *M. avium* typically segregate into transparent (T), opaque (O) and rough colony type variants. Recently, a new morphotypic switch, termed red-white, was observed among *M. avium* colonies grown on agar medium containing the lipoprotein stain Congo red. Compared to red variants, white variants (WT and WO) are more common in patient samples, more virulent in disease models, and more resistant to antibiotics in vitro. In order to better understand the differences between red and white variants, we are studying their basic nutritional requirements for growth in vitro. Red and white variants both grew well on Middlebrook 7H10 Agar medium supplemented with OADC Enrichment (Oleic Acid, Bovine Serum Albumin, Dextrose, and Catalase). However, when grown on Sauton's, a minimal salts medium, RO and RT variants grew much more slowly than WO and WT variants. Through a series of tests supplementing Sauton's with the individual components of OADC, we discovered that the one component necessary for the growth of RO and RT was Bovine Serum Albumin (BSA). We are now seeking to determine the precise basis for the BSA requirement exhibited by red variants. By doing so, we may better understand why red variants do not grow well in host tissues. This in turn will help us to understand how white variants proliferate in host tissues and cause disease.

AIR QUALITY AND INDUSTRIALIZATION IN CAIRO

MADHU NARAYANAN, Atmospheric Sciences and Program on the Environment, Senior
JOHN M WALLACE, Atmospheric Sciences

Cairo, Egypt is plagued with some of the world's worst air quality. Concentrations of several common urban pollutants regularly exceed World Health Organization standards by 10-100 times. This air pollution, comprised mainly of small industrial dust but also of lead and gases, is estimated to be responsible for the deaths of 10,000 to 25,000 Cairenes every year. Much of the air quality problem has been attributed to metropolitan Cairo's swelling population, now believed to be around 16 million people. And yet, just seventy years ago Cairo was a relatively tranquil place with a population barely approaching the one million mark. This seemingly abrupt population boom is a good indicator of the rapid growth Egypt has experienced; but is it the reason for this modern environmental threat? The same period of population growth has been accompanied by rapid industrialization. Many have believed that in order for Egypt to develop economically, it must accept a certain level of environmental damage – dubbed the price of progress. This project looks at how the Egyptian Government, private enterprise, and foreign development institutions have consistently followed an ideology of industrial progress in the growth of Cairo while neglecting its environmental implication. Such a policy has led to air quality issues for Cairo as a whole, and has raised issues of environmental justice in individual Cairo neighborhoods. Even much-heralded milestones, like recent U.S. intervention and the passage of a new Law on the Environment, have done little to address these problems. The project uses information from academic literature and experience from working with the Cairo Air Improvement Project to construct a picture of how a policy of industrialization has banged heads with the health of citizens during the past fifty years.

POSTER SESSION

INTERPRETING EQUIVALENT EQUATIONS: DOES $5A=B$ REALLY MEAN THE SAME AS $B/5=A$?

MARIE TANHUNG NG, Psychology, Sophomore, MARY GATES SCHOLAR
MIRIAM BASSOK, Psychology
KATJA BORCHERT, Psychology

This study investigated students' understanding and interpretation of mathematically equivalent multiplicative (e.g., $5a=b$) and divisional (e.g. $b/5=a$) equations. Previous research suggested that many college students and even a considerable number of faculty members were unable to translate multiplicative equations correctly into verbal statements (Lochhead, J., 1980). Very often, they reversed the meaning of the variables. For example, instead of interpreting the equation " $3d=c$ " (d represents the "number of dogs", c represents the "number of cats") as "there are 3 cats for every dog", students often interpreted the equation incorrectly as "there are 3 dogs for every cat." However, based on Cooper's (1986) finding, the presence of an explicit multiplication sign could improve the accuracy of interpretations. We expanded on this theory and hypothesized that students would make fewer errors in interpreting divisional equations that contain an explicit division sign than equivalent multiplicative equations that do not. In our experiment, we gave college students either a multiplicative or divisional equation and asked them to derive a verbal statement, based on real world situations that corresponded to the equation. The results of our experiment supported our hypothesis. We found significantly more correct verbal statements for divisional than for multiplicative equations. Specifically we found that more students, when interpreting multiplicative versus divisional equations, failed to recognize the equation variables as placeholders for quantities -- they treated the variables as labels for specific objects instead. For instance, they would treat the variable c as "cats" rather than "the number of cats." Future research will investigate the role of the explicit operation signs in divisional and multiplicative equations.

MORPHOLOGY AND DEVELOPMENT OF THE GIANT VACUOLE IN ACETABULARIA ACETABULUM

DUC NGO, Microbiology and Sociology, Senior
PHILLIP GARLAND, Zoology, Senior
JOHN PATRICK LEUTHE, Physics, Senior
DINA MANDOLI, Botany

We have evidence that the central vacuole in giant unicellular alga *Acetabularia acetabulum* maintains 2 suborganellar gradients: pH and dye mobility. We used the pH-sensitive dye neutral red to visualize the vacuole during development, to measure the rate of movement of dye within the vacuole, and to study the vacuole during hair senescence and inheritance. When vegetative most of the rhizoid, the stalk and younger hairs stained with dye suggesting that the vacuole is highly ramified in this unicell. The vacuole filled all compartments of the reproductive structure and was actively incorporated into the haplophase (gametangia). Vacuoles constitutes ~90% of volume of plant cells (Boller et al 1986). Our data calculations revealed that laterals (one whorl of hairs) of adult phase possessed nearly 2X more surface area as the entire stalk yet 3-4 times less volume. Dye movement in the vacuole was slower than diffusion in distilled water implying that the vacuole is more gel than sol. When applied to small regions, dye moved at different rates implying that not all regions of this large vacuole are alike. When just the tip of a hair was stained, dye moved into the stalk from younger hairs, but not from older hairs suggesting that hairs and stalk were connected by one ramified vacuole only in young hairs. The upper angle between the hairs and stalk correlated with hair age. As the hair senesced ($>90^\circ$), the vacuole of the hair disconnected from that in the stalk. Gametangial vacuoles differ in dye color and in the shape and size of the staining pattern and we suggest these observations may relate to development and inheritance of the vacuole. Errors in incorporating the vacuole into gametangia suggest a screen for genetic defects in vacuole inheritance. These data indicate that the vacuole is a polar organelle that actively maintains two gradients.

POSTER SESSION

ULTRASOUND DIAGNOSIS OF CRANIOSYNOSTOSIS

ANH-VU NGO, Biochemistry, Senior, MARY GATES SCHOLAR
RAYMOND SZE, Radiology

Many children (about 1 in every 300 infants) around the world have improper skull and head development (<http://www.cranialtech.com>). A percentage of these children have this abnormal head shape from sleeping primarily on only one side of their heads as infants. Another group of children with similar abnormal head shape have a disease in which the sutures (fibrous joints between the bony plates of the skull), which allow for proper growth and shape, have fused. These two groups are extremely different. The children who essentially have improper sleeping habits can be treated conservatively with a remolding helmet and frequent turning during sleep, while the fused-suture children require surgery. Currently the only certain way to distinguish between the two groups of children is to perform a CT (computerized tomography) scan. Through our research we hope to show that ultrasound is an effective first screening test in diagnosing children with fused skull plates, without the risks of CT scans. Unlike CT scans, ultrasound does not require sedation or use radiation. In addition, it is less expensive than CT and readily available in most hospitals. Our research team feels that there are many children with abnormal head shapes, but no fusion of skull plates, who could be spared the radiation and sedation of CAT scans if ultrasound can be used as an effective preliminary screen. Currently our team has performed preliminary scans on children both with normal and abnormal heads and the sutural areas were clear and easily interpreted as patent or fused. Our team hopes that as more children are enrolled into the project, that these trends will continue and our findings will have a greater statistical foundation. I am in charge of data collection and organization, and will also participate in its interpretation.

HYDROPHOBIC PATCH PRESSURE TRANSDUCTION

THAI NGUYEN, Civil Engineering, Sophomore
NAOMI HAYASHI, Economics, Junior
RAELEEN KNUTSEN, Visual Communications, Freshman
Yael HANEIN, Electrical Engineering

Hydrophobicity may be generally thought of as an appliance for rain protection. Waterproof jackets, boots and umbrellas are all used as defense mechanisms for undesired saturation. Watches have a similar waterproof characteristic, protecting the internal system from water damage. In fact, hydrophobic surfaces are useful for many other aspects of life, such as DNA sequencing, drug and chemical development, and cell testing. The goal of this project was to construct a mechanism facilitating hydrophobic and hydrophilic surfaces in a microfluidic channel to aid in the creation of a pressure scale. Our group focused on a challenging objective: to create a smaller, cheaper version of an internal pressure gauge. Here we are using technologies that have been previously developed but manipulating them to explore further possibilities. Hydrophobic (gold coated with self assembled monolayers) and hydrophilic (oxidized silicon) surfaces are used in this process. This technology offers simplicity compared with contemporary methods.

POSTER SESSION

FIBEROPTIC IMAGE ACQUISITION SYSTEM

JONATHAN NICHOLS, Pre-Major, Freshman
AMBER HUDSON, Pre-Major, Freshman
JEFFREY DEE, Chemical Engineering
CHRIS TAKAHASHI, Pre-Engineering, Sophomore
WEI-CHIH WANG, *Mechanical Engineering*

The demand for minimally invasive medical procedures has increased the demand for ultra-thin optical endoscopes. However, commercial flexible endoscopes have a fundamental tradeoff of size versus image quality. The smaller the endoscope diameter the lower the image resolution and/or field of view (FOV), such that image quality deteriorates. The proposed research is designed to overcome this fundamental limitation by making a very small, flexible image acquisition system with high resolution and FOV. The proposed scope and display system is fundamentally different in their methods of image acquisition and generation than existing endoscopes and display system. The proposed scanner does not require a minimum physical size for capturing an image on a spatial array of imaging pixels. No spatial array of photodetectors (such as camera or fiber bundle) is used for image capture. Instead, the image is generated by scanning white light from a single optical fiber. This back scattered light is captured by a photodetector, processed, and from this an image can be produced. This system provides a real time zooming possibility without losing resolution. The system is compact and will provide many new applications in non-invasive image acquisition.

SNAKE FEAR IN LABORATORY REARED PIG-TAILED MACAQUES (*MACACCA NEMISTRINA*)

CHRIS NIELSEN, Psychology, Senior, MARY GATES SCHOLAR
RANDALL KYES, *Psychology*

Eight laboratory reared juvenile Pig-tailed macaques (*Macaca Nemestrina*) were placed in an open field enclosure and presented with seven images consisting of both snakes and novel stimuli. The animals were allowed a 10-minute habituation period followed by 30-second slide presentations with 2-minute inter-slide intervals. Various reactions were measured in an attempt to determine whether lab reared animals may possess the ability to identify potentially dangerous predators, and to what extent, if any, these abilities are developed. As of this writing, findings point to trends illustrating mild-to-weak reactions to snake images when compared to control images, which supports much of the current body of research. Further statistical analysis will assist in determining to what extent the subjects react to images of potential predators compared to control images.

POSTER SESSION

MAGNETIC PROBES FOR PLASMA PHYSICS

PETER NORGAARD, Aeronautics and Astronautics, Sophomore, SPACE GRANT SCHOLAR
URI SHUMLAK, Aeronautics and Astronautics

The University of Washington ZaP Flow Z-pinch experiment is one of the many plasma-physics research projects currently underway throughout the world that aim to confine plasma to a region using magnetic fields. Plasma is superheated gas that has completely ionized and as a result conducts electricity. Current-carrying plasma generates a confining magnetic field. If the duration of confinement can be increased, the plasma will achieve sufficient energy to undergo fusion. A better understanding of plasma behavior will therefore help scientists and engineers in their efforts to build such devices as rocket thrusters and fusion power plants. The greatest obstacle to successful plasma confinement is instability, which is the plasma's tendency to break apart. The ZaP experiment is a unique design that enhances stability by creating a varying axial flow. One of the diagnostics that helps monitor this instability in the ZaP experiment is a set of four partial Rogowski probes. These probes detect changes in the plasma's magnetic field. As the plasma moves the strength of the field fluctuates, so by measuring these fluctuations we can approximate the motion of the plasma. Computer analysis of the data helps to compensate for the probe's limitations to create a clearer picture of the plasma's behavior. At present the ZaP experiment is running with a second-generation design of Rogowski probes, and the process of data analysis is underway. This analysis should improve our understanding of plasma instabilities in the ZaP experiment, and will hopefully contribute to our greater understanding of plasma.

THE ASSOCIATION BETWEEN THE DEVELOPMENT OF PARKINSON'S DISEASE AND A GENETIC POLYMORPHISM IN THE NQO2 GENE

STARLYN OKADA, Pre-Major, Sophomore
HARVEY CHECKOWAY, *Epidemiology and Environmental Health*
FEDERICO FARIN, *Environmental Health*

Parkinson's disease (PD) is a progressive neurodegenerative disorder linked to gene-environment interactions. Many studies have investigated the association between oxidative stress generated by detoxification of neurotoxic compounds and the development of sporadic PD. The dihydronicotinamide riboside (NRH): quinone oxidoreductase 2 (NQO2) gene transcribes one of the two enzymes responsible for the detoxification of quinones and cellular protection against quinone induced oxidative stress. A positive association between an insertion/deletion polymorphism in the NQO2 gene and the development of PD in an ethnically Japanese population has been reported. Due to different allele frequencies among various ethnic populations, we examined the relationship between this NQO2 polymorphism and the development of PD in an age and sex matched, Caucasian study population consisting of 45 PD patients and 47 controls. For this study, a polymerase chain reaction (PCR)-based assay was developed to identify this NQO2 polymorphism. Subsequent PCR products were examined using established agarose gel electrophoretic methods. Selected samples were confirmed to be either wildtype or heterozygous for this polymorphism through DNA sequencing of the PCR products. No homozygous mutant genotypes were detected. Analysis of the genotyping results suggests a weak correlation between this NQO2 polymorphism and the development of PD. The observed distribution of the homozygous wildtype genotype versus the heterozygous genotype lacked statistical significance (odds ratio: 1.6; 95%CI: 0.3 - 10.1), 3 PD patients (6.7%) and 2 controls (4.3%) showed the heterozygous genotype. Our results do not support the positive correlation between this NQO2 variant and the development of PD described in a prior Japanese population study; however, this discrepancy is likely due to the small size of our study group. Additional NQO2 genotyping involving a larger group of Caucasian PD patients and controls is currently being addressed.

POSTER SESSION

MONITORING THE EFFECTS OF HIGH INTENSITY FOCUSED ULTRASOUND ON THE BRAIN

RYAN OLLOS, Physics, Senior, MARY GATES SCHOLAR , SPACE GRANT SCHOLAR
PIERRE MOURAD, Applied Physics, Neurosurgery
LAWRENCE CRUM, Applied Physics, Bioengineering

High Intensity Focused Ultrasound (HIFU) is presently being developed for a number of therapeutic purposes with medical applications ranging from non-invasive surgical techniques to enhanced drug delivery. Research in collaboration between the Applied Physics Lab and the Department of Neurosurgery hopes to extend the applications of HIFU to the brain. HIFU has been shown to transiently permeabilize the Blood-Brain Barrier (BBB), an important step to enhancing the transport of drugs into tumors, and for drug delivery to other parts of the brain to treat diseases like Parkinson's disease and epilepsy. The mechanisms by which ultrasound affects the blood-brain barrier are not fully understood. An important aspect in the realization of the potential of HIFU is the ability to monitor dose and subsequent biological changes to the insonated tissue. The acquisition and subsequent analysis of diagnostic pulses will allow for the treatment to be monitored and thus given in a controlled manner. Information obtained during treatment will allow for improved analysis of the subsequent effects and ultimately lead to a better understanding of the effects of HIFU on the brain. We hope to control the biological effects to achieve the desired therapeutic benefit by determining the necessary exposure parameters and conditions. Data obtained from a phantom model and *ex-vivo* tissue samples is used to evaluate methods of signal analysis. Our understanding of the changes that occur in tissue with the application of HIFU will soon lead to implementation *in-vivo*.

AMERICAN DIORAMAS: THE PATHOS WITHIN

CHRISTINA OLSEN, Painting, Senior
ANN GALE, Painting

Throughout history, oil painting has been used as the traditional medium to create art. In so being, it has set up the canon of formal composition, which other art forms then follow. Also, the tradition of painting in the past embodied a kind of classical language, used as a vehicle to communicate to the illiterate masses in an elitist society. For example, paintings could graphically interpret passages from the Bible when people couldn't read Latin. Today painting is still considered as catering to high society, and therefore reflects this in content: formal landscapes, portraits and still life. Oil painting is my medium of choice to invent irony: a paradox to traditional resolve. Why not use the traditional formal elements in painting dealing with space, atmosphere, color, etc., but use it in the modern vernacular? Use paintings to catalyze thought, insight, and literacy to the masses rather than just accommodating the literati. In my paintings, I hope to convey intimate reflections of the vulnerabilities, fears and strengths of Mankind in the guise of humorous pathos. The process, which I follow to create my work, begins by constructing a diorama. The subjects that I choose to star in my dioramas are those that will best convey a narrative that I have in mind, dealing with my reaction to ridiculous situations that we find ourselves in everyday. Dioramas allow me to paint by observation, not just literally, but also conceptually. I am able to manipulate the interaction and visual dialogue between the characters and also control the light source to create mood, drama, and atmosphere. Also, dioramas serve as the perfect scenario from which to extract information because they represent the convenient, to-go, one stop-shopping attitude of consumer America. The process of the painting must complement its purpose. In painting the idea of research and the creative process are so fundamentally intertwined that the two cannot be discussed separately.

POSTER SESSION

THE PERCEPTION AND IMAGINATION OF FACES (AND HOUSES) IN CHILDREN: AN FMRI STUDY

JENNIE PARK, Psychology, Senior, MARY GATES SCHOLAR
ELIZABETH AYLWARD, Radiology

Our ability to recognize each other's faces is a talent at once experientially effortless and scientifically perplexing. A cognitive psychological explanation of the human mind's ability to recognize human faces is inspired and orchestrated by the question of the relative uniqueness of the human face among other visible entities. Does the human mind consider human faces qualitatively different from objects and words, as a modular or faculty model of cognition would purport (Fodor, 1983), or does the mind use similar strategies in recognizing all visual entities, as a more parsimonious, shared-systems view of visual recognition would purport (Farah, Wilson, and Tanaka, 1998)? Resolution of this debate requires an understanding of the developmental course of face representation in the human mind. Our present study, hence, seeks to determine how the brain responds across several childhood years to the perception and imagination of human faces. Does the brain rely on the same strategy to record, recall, and identify faces from age 8 through age 14, or somewhere in the middle does it revise its strategy? The fusiform gyrus is a brain region responsive in adults during the perception of faces; this study explores using functional magnetic resonance imaging (fMRI) to ascertain whether this region is also active in children when they view as well as imagine faces, and whether this activation changes as they develop more advanced strategies for face perception, memory, and imagination. Results from a memory test not involving MRI scanning in the study will further indicate whether children ages 12-14 utilize the relatively automatic strategy of adults in remembering faces and houses, and whether children of the younger age group—8-10 years—utilize a more deliberate strategy as has been found in prior literature. To date, no published fMRI studies explore activation attendant to the processing of faces in children's brains.

EFFECT OF ULTRAVIOLET LIGHT TREATMENT ON HETEROTROPHIC MARINE BACTERIA- EVALUATION OF A TECHNOLOGY TO TREAT BALLAST WATER IN SHIPS

BENJAMIN PAULSON, Biochemistry, Senior
RUSSELL HERWIG, Aquatic and Fishery Sciences

Aquatic nuisance species may be introduced from one area of the world to another by transport in ballast water. These organisms, such as zebra mussels, have caused serious ecological disruption and economic impact. Investigators are proposing and testing several technologies that could be used to inactivate organisms present in ballast water. One of the proposed technologies is ultraviolet light (UV). To test the effectiveness of UV, we conducted small-scale experiments using Puget Sound water at the USGS Marine Laboratory at Marrowstone, Washington. These experiments were done using two systems, a capillary flow reactor and a collimated beam apparatus. Both systems provide a uniform dose of UV radiation to the sample. During these tests, we were able to determine not only how different levels of UV dosage initially affected a sample of heterotrophic marine bacteria, but also how well the treated bacteria were able to grow following a 48-hour incubation period. Results from these experiments showed a 10,000-fold reduction in culturable bacteria following a UV radiation dose of 75 mW·sec/cm². This indicated either complete inactivation of bacterial reproductive ability, or at least a significant period during which DNA damage inhibited reproductive function. However, a 100 to 1,000-fold rise in culturable bacteria was observed following the 48-hour incubation period, showing the ability of some bacteria to reproduce. Using fatty acid analysis we determined the relatedness among bacterial strains isolated from these experiments. In addition, we are establishing UV dose response curves for some of the more UV radiation resistant bacterial isolates. While UV radiation appears effective in lowering the population of culturable marine bacteria in seawater, the issues of bacterial growth and the possible selection of UV-resistant microorganisms needs to be addressed.

POSTER SESSION

TOPOGRAPHICALLY DRIVEN MEAN OCEANIC FLOW

DAVID PETERSON, Pre-Engineering, Sophomore, SPACE GRANT SCHOLAR
PETER RHINES, Oceanography

There are many factors that cause ocean currents to move as they do, which in turn has a large impact on the weather. One of these factors is the topography that the currents flow over. The seafloor has mountains and valleys of many scales, from small bumps that affect the tides to great tectonic features that control the global circulation. For this project an experiment was conducted to see how our topography consisting of five symmetric mountains affected the overall circulation in our simulated ocean basin. The cylindrical tank representing our basin was placed on a computer controlled, rotating table and the speed of the table was oscillated. This oscillation of water over the mountains caused the shedding of eddies that organized to create mean flows in the tank. A Laser Doppler Velocimeter was used to measure the velocity of the water at various points in the tank, the data were then used to calculate mean flows. The data gathered thus far have shown that the mean flow increases as you move out along the tank's radius to the distance the mountains are located, then decreases and goes the opposite direction as the edge of the tank is approached. This type of flow was expected; however, it was also found that when the amplitude of the oscillation was small, the mean flows went in the opposite direction, a phenomenon not yet understood.

POLYMERASE CHAIN REACTION AND HISTOLOGY IN TESTING GENE FUNCTION IN MICE

ABIGAIL PLAWMAN, Biochemistry, Junior
CARMEN BOOTH, Pathology
DAN BOWEN-POPE, Pathology

With the advent of molecular biologic techniques, the ability to selectively inactivate specific genes through homologous recombination in mice has become a common method used to elucidate specific gene functions. Once a hypothesis about gene function has been formulated, one way to test it is to raise a large number of mice homozygous for the inactivated gene (referred to as "knock-out" or KO). If the gene is hypothesized to be a tumor suppressor, the number, type of tumors present, and age that tumors develop in KO mice are compared with the results for age and sex matched "wild-type" (WT) control mice who have the normal functioning gene. The KO mice should develop more tumors at an earlier date than their WT counterparts if the hypothesis is correct. As a component of our work on projects of this nature, accurate determination of the specific genotype (KO, WT, or heterozygote) of each mouse is crucial. Of the methods commonly used for determining genotype, polymerase chain reaction (PCR) is the least complicated and fastest to regularly perform. PCR provides a method of selectively amplifying specific regions of DNA that differ in size between the two lines of mice. We then determine the genotype by comparing the size of the amplified bands of DNA from each mouse with a standard sample of predetermined size. The two projects that I am currently working on involve genotyping numerous mice involved in one phenotype study and the verification of genotype in a large aging study of another line of KO and WT mice. In the latter, I am also involved in necropsy (tissue dissection) of the mice and collection of tissues for histology. By examination of KO and WT mouse tissues both grossly (macroscopically) and microscopically, the effect of the gene of interest on tumor growth may be determined.

POSTER SESSION

APPLICATIONS OF MACHINE LEARNING TECHNIQUES IN DIGITAL PROCESSING OF IMAGES OF THE MARTIAN SURFACE

CATHERINE PLESKO, Physics, Junior, MARY GATES SCHOLAR, SPACE GRANT SCHOLAR
CONWAY LEOVY, *Atmospheric Sciences*
JOHN ARMSTRONG, *Astronomy*

NASA spacecraft have now returned many thousands of images of the surface of Mars. It is no longer practical to analyze such a large dataset by hand, while the development of handwritten feature extraction tools is expensive and laborious. This project investigates the application of current machine learning techniques to problems of feature extraction and digital image processing within the Mars dataset.

NON-POINT POLLUTION IN NORTH CREEK, SNOHOMISH COUNTY

VICTORIA POLING, Sustainable Resource Science, Sophomore, MARY GATES SCHOLAR
MICHAEL BRETT, *Civil and Environmental Engineering*
BEN BRATTEBO, *Civil and Environmental Engineering*

Excess soluble reactive phosphorous (SRP) input into streams and other surface water bodies can lead to a decline in stream health by contributing to algae blooms. In a 2001 King County Surface Water Management Study, North Creek showed unexpectedly high levels of SRP dissolved in the water. The goal of my project is to locate possible sources of phosphorous input into North Creek. If specific sources are identified, this information could provide targets for stream quality improvements. North Creek flows primarily through Snohomish County and empties into the Sammamish River near the UW-Bothell campus. To determine possible sources of excess nutrients, I will take water samples from multiple locations along the stream, as well as from its tributaries. These samples are then analyzed for the concentration of SRP. I will also measure stream flow at each sample site in order to determine how much SRP passes through the sites on a daily basis. Initial data show high SRP input at the sample sites in the urban Everett area, as well as in drainage from suburban and technology-campus developments. At this point, high SRP levels can tentatively be traced to street and parking lot runoff.

POSTER SESSION

SUPRALITTORAL INVERTEBRATES OF CENTRAL PUGET SOUND

DANIELLE LEAF POTTER, Anthropology and Psychology, Senior, MARY GATES SCHOLAR
CHARLES SIMENSTAD, Aquatic and Fishery Sciences
KATHRYN SOBOCINSKI, Aquatic and Fishery Sciences

This project examines the relationships between the supralittoral zone of modified and unmodified Puget Sound shorelines and how populations of benthic invertebrates and insects differ with these alterations. The supralittoral zone is the uppermost portion of the beach that is affected by spring tides. This area may be an important contributor to the food resources of nearshore fish, such as salmonids, by providing terrestrial insects to the marine system. By understanding how the alteration of the coastline affects the invertebrates of the supralittoral zone, we may in turn draw inferences about the food available for the juvenile fish. This study is a sub-section of a larger study entitled "Supralittoral Ecology: Invertebrate assemblages and the impact of shoreline armoring in central Puget Sound" being conducted by Kathryn Sobocinski, a graduate student at the School of Aquatic and Fishery Sciences and a member of the Wetland Ecosystem Team (WET). Kathryn collected the benthic invertebrate cores from twenty-five different sites in central Puget Sound during July 2001. I will use these samples to assess the abundance of beach-hopper amphipods, collembola, and insects, all of which are known food sources for juvenile salmonids. Data will be analyzed using statistical tests to determine if there are any significant differences between the numbers and types of benthic invertebrates and insects found in the modified and unmodified supralittoral sites. From these data, we can make more informed decisions regarding the modification of shoreline habitats and assess the harm that shoreline modification may have on the feeding opportunities for native fish species.

DEVELOPMENT OF A REFINED MEASUREMENT OF THE SEEBECK COEFFICIENT

MICHAEL PROWSE, Ceramic Engineering, Senior
FUMIO OHUCHI, Materials Science and Engineering

Thermoelectric materials have great potential for solid-state refrigeration and power generation, yet procedures for measuring the thermoelectric (Seebeck) coefficient have not advanced in decades. We have developed a refined method of measuring the Seebeck coefficient, and applied to materials currently under investigation. A thermoelectric material is a material that produces a current in the presence of a temperature gradient. The Seebeck coefficient is a measure of this current. The method that we developed allows the measurements under vacuum and/or controlled atmosphere so as to eliminate the affects of thermal convection. Electrical connections were made so as to measure both the thermoelectric voltage and the temperatures at the same point on the sample without electrical interference. The materials under study are complex nickel-cobalt-copper-manganese-oxides. The unique feature of these materials is that the electrical conduction occurs by electrons hopping from one manganese site to the next site in the crystal structure. This conduction mechanism also allows for electrical conduction to occur while limiting thermal conduction. This is quite important for thermoelectric material. The efficiency of a thermoelectric material depends on both electrical and thermal conduction as expressed by a figure of merit,

$$ZT = \frac{TS^2}{\rho}$$

where ZT is the figure of merit (efficiency), and S, ρ and T are the Seebeck coefficient, electrical conductivity, thermal conductivity, and temperature, respectively. An ideal material will be electrically conductive and at the same time be a poor thermal conductor. The material we have developed has fair electrical conduction, poor thermal conductivity, and a large Seebeck coefficient of between -120 to -150 μ V/T was measured.

POSTER SESSION

SYNTHESIS AND DESIGN OF LUMINESCENT MATERIALS

LAFE PURVIS, Chemistry, Senior

LARRY DALTON, Chemistry

GREG PHELAN, Chemistry

Novel luminescent materials based on europium-cored complexes have been designed and synthesized. Emission of optically pure (FWHM = 5nm) light has been observed at 610 nm. The complexes consist of a single europium atom surrounded by three or more organic ligands. These ligands consist of either polycyclic aromatic compounds or dendritic functionalized methyl esters. The absorption, photoluminescence and electroluminescence properties of these complexes were investigated.

MOBILE MONITORING OF UNDERGROUND CABLE SYSTEMS

MICHELLE RAYMOND, Electrical Engineering, Senior, MARY GATES SCHOLAR, SPACE GRANT SCHOLAR

PAUL STUART, Electrical Engineering, Senior, MARY GATES SCHOLAR

ALEXANDER MAMISHEV, Electrical Engineering

Accurate, real time information about the aging status of the power distribution cable network could potentially save the power industry billions of dollars in lost revenue due to line failures and premature replacement of cables. Hence, a novel, semi-autonomous robotic platform has been developed for monitoring underground, power distribution cable systems equipped with an array of infrared, dielectrometry, and acoustic sensors. A unique legged configuration allows the robot to traverse 3" diameter cables and negotiate obstacles along its path. The platform's modular design consists of a multi-processor control board, a 900Mhz wireless communication module and multiple sensor arrays. The robot is capable of full autonomous operation, or human tele-operation via a LAN or Internet connection. A prototype platform has been developed and currently sensor integration is underway.

POSTER SESSION

UW TRANSLIFE MISSION

KATHERINE READY, Aeronautics and Astronautics, Senior
ZACHERY ADAM, Aeronautics and Astronautics, Senior
BENJAMIN BEEBE, Aeronautics and Astronautics, Senior
BRIAN BLOUDEK, Aeronautics and Astronautics, Senior
DOUGLAS BROWNING, Aeronautics and Astronautics, Senior
MICHAEL CAPINPIN, Aeronautics and Astronautics, Senior
PAUL FORQUERA, Aeronautics and Astronautics, Senior
SHANE GILLET, Aeronautics and Astronautics, Senior
MARCUS HOLZINGER, Aeronautics and Astronautics, Senior
DEREK INABA, Aeronautics and Astronautics, Senior
MICHAEL JARVIS, Aeronautics and Astronautics, Senior
SCOTT JUEFLS, Aeronautics and Astronautics, Senior
DAVID KASPRZYK, Aeronautics and Astronautics, Senior
DAVID LANDON, Aeronautics and Astronautics, Senior
JOSHUA LEINGANG, Aeronautics and Astronautics, Senior
GRADY LEMOINE, Aeronautics and Astronautics, Senior

AUTUMN LEWIS, Aeronautics and Astronautics, Senior
JOHN LIANG, Aeronautics and Astronautics, Senior
VARO LY, Aeronautics and Astronautics, Senior
THOMAS O'BRIAN, Aeronautics and Astronautics, Senior
JOSHUA PIEPER, Aeronautics and Astronautics, Senior
ANDREY REKHTIN, Aeronautics and Astronautics, Senior
JUSTIN REUTER, Aeronautics and Astronautics, Senior
THOMAS ROSE, Aeronautics and Astronautics, Senior
VALERIE STANLEY, Aeronautics and Astronautics, Senior
WESLEY URBAT, Aeronautics and Astronautics, Senior
JEREMY WELCH, Aeronautics and Astronautics, Senior
ADAM WUERL, Aeronautics and Astronautics, Senior
JEREMY ZANZIG, Aeronautics and Astronautics, Senior
***BOGDAN UDREA**, Aeronautics and Astronautics*
***ADAM BRUCKNER**, Aeronautics and Astronautics*
***CHARLIE VAUGHN**, Aeronautics and Astronautics*
***MARTIN HOUSTON**, Aeronautics and Astronautics*

The objective of the Mars Society's Translife Mission is to determine the effects of Mars-level gravity (0.38 g) on adult mice and on their offspring. The Translife mission spacecraft designed by the University of Washington's Department of Aeronautics and Astronautics will accomplish these goals. The Translife mission spacecraft will be built in two parts. One part will consist of a re-entry vehicle designed to return the mice to Earth safely. This re-entry vehicle will contain the mouse habitat, the life support system, and all equipment needed to ensure a successful recovery. The second part of the spacecraft will be an octagonal bus that will provide power to the re-entry vehicle, relay telemetry including pictures of the mice in their habitats from the re-entry vehicle to ground stations on the Earth, provide propulsion for altitude control and deorbit, and house all other systems that are not critical to recovery of the mice. This design was chosen to minimize re-entry vehicle mass, thus reducing re-entry heating, and to allow greater freedom in the design of those parts of the spacecraft that do not have to return to Earth. This proposal will first give a brief overview of the mission operations; next, the spacecraft sub-systems will be discussed, starting with the Environmental Control Life Support system, the most critical subsystem aboard the satellite. Finally, the text will finish with a summary and conclusion.

IS IT REALLY ABOUT FIGHTING POVERTY?: WHAT INFLUENCES CONGRESSIONAL ATTENTION TO ISSUES OF SOCIAL WELFARE

DAVID ROBERTS, Political Science and Business Administration, Senior
***BRYAN JONES**, Political Science*

What causes changes in Congressional attention to issues of social welfare? Do changes in Congressional attention relate to changes in poverty rates? public attention? or just politics? Little attention has been paid to understanding what actually influences Congressional attention to issues of social welfare despite the amount of time and energy spent on such issues. This study is designed to clarify the politics of welfare. My hypothesis is that there is a positive correlation between the poverty rates of the very poor in the United States and Congressional attention to social welfare issues. The theoretical grounding of this study is the punctuated equilibrium theory as developed by Baumgartner and Jones in *Agendas and Instability*, 1993. Statistical analysis will be conducted to determine the relationship between poverty rates, economic indicators, mass public attention, and Congressional attention. I expect to find that there is a positive relationship between poverty rates and the amount of attention Congress places on issues of social welfare. This positive relationship will also likely exist between public attention, poverty rates, and Congressional attention.

POSTER SESSION

AGING AND THE NEURAL REPRESENTATION OF SIMPLE AND COMPLEX SOUNDS

NEERU ROHILA, Speech and Hearing Sciences, Senior
KELLY TREMBLAY, Speech and Hearing Sciences

Communication disorders due to age related hearing loss affects one in every three adults. Hearing aids are often recommended to compensate the loss; however, the success rate of hearing aid users varies. Approximately 40 to 60 percent of hearing aid users do not report being satisfied with their hearing aid device. Because most hearing impaired people are elderly, the contribution of age needs to be studied. Previous research has found that with age, neurons in older brains do not fire as synchronously as they do in younger brains. This loss of synchrony may correlate to poor discrimination of speech sounds. Hearing aids only amplify auditory signals, they do not compensate for age related dysynchrony problems. Therefore, using electrophysiology, we chose to examine the N₁ P₂ complex, which reflects synchronous neural activity from the cortical auditory region of the brain. Specifically, representation of the speech sound /pa/ as well as a 1000Hz tone will be studied, both stimuli will be presented at the same rate to older and younger normal hearing listeners. Previously, research has found a delay in the N₁ P₂ complex in speech sounds. The purpose of this project will be to determine if latency delays are specific to speech, or are they present in response to tones as well. With further exploration of how the auditory portion of the brain contributes to hearing, better aural rehabilitation methods can be developed.

DEVELOPMENT OF A MODULAR MICROFLUIDICS LIBRARY FOR GENOMIC RESEARCH APPLICATIONS

GABE ROWE, Electrical Engineering and Biochemistry, Junior
MARK HOLL, Electrical Engineering
Yael HANEIN, Electrical Engineering

The ability to quickly perform simple screening level experiments on living cells is a central need of Microscale Life Sciences Center (MLSC) activities at the University of Washington. Within the larger mission of the MLSC investigators seek a detailed understanding of a broad range of tightly focused genomic and Microsystems integration questions. These questions range from the gene expression as a function of microenvironmental chamber changes to the MEMS design and optimization of conformal protein resistant coating. Our research project entails the compilation of a library of standard microfluidic flow channels as well as the design of new research devices. Our microfluidic channels are modular, flexible silicone based constructs fabricated with the intent of guiding minute volumes of fluid, from a sample vial, to the surface area of a substrate. The general nature of our library element production methods enables the examination of a number of hybrid design configurations. The benefits of these devices include batch fabrication, reusability, and low toxicity. Application of these devices range from educational purposes, to actual research in the laboratory for various functions, such as single cell sorting, retrieval of specific individual cells, hydrophobic microfluidic devices, etc. The fabrication of these microfluidic devices entails the use of photolithography techniques to create the channel design on the surface of silicon wafers. By implementing successive steps of molding and casting the final microfluidic device is obtained. We present our current catalog of library elements as well as exemplary device performance results.

POSTER SESSION

DEVELOPMENT OF A SYSTEM TO DETECT GREEN FLUORESCENT PROTEIN

CINDY RUECKERT, Electrical Engineering, Senior, MARY GATES SCHOLAR
DENISE WILSON, *Electrical Engineering*
MARK HOLL, *Electrical Engineering*

Green fluorescent protein (GFP) is a biological indicator at the molecular level. Many applications in biological analysis need a compact device to accurately detect low levels of GFP in different samples. We have researched and designed a compact analysis system for GFP detection. This system includes a microfluidic sampling system that minimizes optical scattering and photonic noise introduced in the path of detection. Different layouts of the microfluidic systems are compared to evaluate which design generates the maximum amount of fluorescent light. From the sample, optical fibers channel the fluorescent light to the photodetection system. A microcontroller is used to maintain the excitation light at a constant intensity as well as to extract the signal from the photodetection device at a set of operating parameters best suited to the level of detection. A blue LED is used to excite the sample and different photodetection devices are compared and contrasted to evaluate which device can best detect the fluorescence of the sample in a compact, low power envelope.

POPULATION DYNAMICS OF *DAPHNIA MAGNA* IN RELATION TO CARRYING CAPACITY IN CLOSED ECOLOGICAL SYSTEMS

YUICHI SAITO, Aquatic and Fishery Sciences, Senior
DAVID BARBEE, Aquatic and Fishery Sciences, Senior
FRIEDA TAUB, *Aquatic and Fishery Sciences*

The ecological system of our planet supports all living organisms and functions with little substance exchange from outer space. Radiation from the sun is the only substantial input to the earth, and it powers many ecological systems. These systems are interdependent and can be considered as a self-sustaining closed ecological system with the Earth's atmosphere as its boundary. How the closed system is sustained is inscrutable to us because of its complexity and scale. Nevertheless, we may be able to study the concept of the self-sustaining ecological system by creating miniature systems. We have established three sizes of Closed Ecological System (755, 272, 73 ml) consisting of inorganic medium, two species of algae, and the grazer *Daphnia magna*. Six replicates of each size were sealed to minimize gas exchange, and six were left open to the atmosphere to allow gas exchange. Open and closed systems have recruited the same light energy, (18 hours of light and 6 hours of dark) and have been maintained at 20 °C. This experiment has been running for about a month. Our goal is to experimentally verify if there is any difference in density of *Daphnia magna* in three different sizes of flasks. By day 29, *Daphnia magna* populations have been sustained in 32 out of 36 ecosystems. The larger containers have a greater number of *Daphnia magna*. The sealed systems to date are approximately as successful supporting *Daphnia magna* populations as the open systems, suggesting dissolved nutrients nitrogen and phosphorous are more likely to be limiting than gaseous oxygen or carbon dioxide. Observation will continue.

POSTER SESSION

THE AMERICAN DREAM: A COMPARATIVE STUDY OF PUBLIC HIGH SCHOOL PREPARATION FOR COLLEGE

MEGAN SALMON, International Studies, Sophomore
ANA MARI CAUCE, *Psychology*

Higher education is the mark of success in today's world. The societal perception of success is often shaped by the amount of education that someone has: PhD, MBA, MD, etc. In the Seattle School District, less than one in four students will go on to college, and even fewer than that will graduate. These figures are disturbing. While not totally unusual for an urban school district, there are other schools that have much better figures. This begs the question: why are schools in certain states able to produce a higher percentage of college-bound seniors than the Seattle schools? Based upon statistics on fourth, eighth, and tenth grade general skills test scores from the U.S. Department of Education and the Educational Testing Service, three states have been chosen to compare with Seattle Schools: Minnesota, Wisconsin, and Massachusetts. From these states, information is gathered from a variety of sources about the level and type of preparation given to their students. My hope is that I will be able to compile this information in a comprehensive plan and present it to the Seattle School District to help them increase the number of college bound seniors in the coming years. The bulk of research for this study will be conducted through interviews with staff, teachers, and counselors with 12 public high schools in four different states: Minnesota, Wisconsin, Massachusetts, and Washington. Within each school, four to seven members of staff and faculty have been invited to answer ten to thirty questions regarding their school's policies, curricula, and approaches in preparing their high schoolers for two- and four-year colleges.

DNA-BINDING PROTEINS ON HOLLIDAY: INTERACTION OF χ UBF HMG BOX 1 WITH A FOUR-WAY JUNCTION

ANTHONY J.M. SALTER, Biochemistry and Physics, Junior
RACHEL KLEVIT, *Biochemistry*

The Holliday Junction represents a critical intermediate in the physical model for DNA recombination. Consisting of twin double-helical strands entwined in a four-way stacked "X" configuration, the Holliday Junction allows for a high rate of strand-to-strand base-pair interchange leading to genetic diversity amongst organisms. High torsional stress at the center of the junction makes the conformation unfavorable, and synthesis of small, stable versions that are amenable to structural characterization has been difficult. Here we utilize a novel self-complimentary DNA sequence (3'CCGGTACCG-5') previously identified to crystallize in a four-way junction and attempt to characterize its ability to form a stable Holliday intermediate in solution. Recent experiments exposing the sequence to divalent cations have shown promising results in this regard. If confirmed, this DNA will assume the smallest known solution-stable Holliday intermediate, allow for powerful tools such as NMR spectroscopy to be utilized. The ability to use these spectroscopic tools is critical to the main focus of the project: structural characterization of Holliday intermediate-binding protein complexes. Specifically, the *Xenopus laevis* Upstream Binding Factor High-Mobility Group Box One protein (χ UBF HMG Box 1) is a non-specific DNA binding protein that exhibits high affinity toward certain DNAs; previous analysis of this protein revealed a preference for the Holliday Junction structure. Upon confirmation of a stable junction in solution, we will attempt HMG binding to the intermediate to determine the structure of the protein-DNA complex as well as the associated binding mechanism. Our goal is to understand as many of the details surrounding how non-specific DNA-binding proteins interact with DNA recombination as possible, as well as offer insight into the structure of other non-specific DNA-protein complexes and their associated functions.

POSTER SESSION

PEDIATRIC BRAIN TUMORS

MARC SCHLEH, Biochemistry, Junior
JOHN SILBER, Neurosurgery
MICHAEL BOBOLA, Neurosurgery

Brain tumors account for the majority of pediatric cancer-induced deaths. These fatalities are caused most often by tumors called Gliomas and Medulloblastomas; each gives its host a poor prognosis for survival. Treatment with Chemotherapy (CT) and Radiation Therapy (RT) increase patients' chances for survival. These treatments, however, often encounter resistance. DNA repair has been implicated as a factor in tumor resistance to RT and CT. The DNA repair enzyme apurinic/apyrimidic endonuclease (APE) increased cellular tumor survival by repairing Radiation- and Chemotherapy-induced DNA damage. APE has a heightened activity and presence in the tissue of a brain tumor; in general, APE is five fold less active in normal brain tissue than in brain tumor tissue. The goal of researching APE's function in brain tumors is to determine the extent to which it contributes to CT and RT resistance in pediatric patients. Its importance is determined by measuring its ability to repair brain tumor tissue removed from pediatric patients at Children's Hospital and Regional Medical Center.

DISCOVERY AND ANALYSIS HUMAN GENETIC VARIATION

DAVID SCHRUTH, Biochemistry, Senior, MARY GATES SCHOLAR
MAYNARD OLSON, Genome Sciences

With the Human Genome Project's first draft near completion, the next important step is to study the genetic variation within the population at large. Although the neutral theory of molecular evolution allows for some variation within a population, preliminary analysis of the raw data from the Human Genome Project has suggested that some regions have atypically high levels of variation. The initial goal of this research is to validate the existence of these regions by re-sequencing a sampling of candidate regions from the genomes of many individuals. For validated cases, the pattern of variation will be analyzed in order to determine whether it is more consistent with unusually high mutability or the effects of balancing selection. Methods employed in this research include the Polymerase Chain Reaction [PCR] and the Sanger Sequencing method. To date, preliminary data sets from 17 different loci have been obtained for 12 different people. Each locus spans approximately 500 base pairs and contains an average Single Nucleotide Polymorphism [SNP] density of 7 differences per 1000 base pairs (1kbp). This density is much higher than the genome average of 1 SNP per kbp. Some of the loci, however, show little or no variation in the panel of 12 individuals. In these cases, the preliminary analyses that led to the identification of these regions as high-variation candidates were apparently based on incorrect assumptions. Analysis of the new data casts some light on the specific assumptions that are most suspect.

POSTER SESSION

REGULATION OF BRAIN WATER CONTENT FOLLOWING TRAUMATIC BRAIN INJURY IN THE RAT

ANKUR SHAH, Biology, Senior
RAIMONDO D'AMBROSIO, Neurological Surgery

The life-threatening consequences of posttraumatic brain edema has been well documented. While the exact mechanisms of how brain edema forms are not completely understood, several mechanisms have been explored. One of the major hypotheses is that cytotoxic edema and cell swelling are due to intracellular accumulation of ions. Therefore, targeting ion-buffering cellular mechanisms could ameliorate posttraumatic cytotoxic edema. This avenue of investigation has been pursued in the past, but no systematic screening of drugs has been performed. To this end, we use the fluid percussion injury (FPI), a clinically relevant animal model of traumatic brain injury (TBI), and measure the water content of rat brain slices obtained two days following FPI. Thus far, we have found that the water content of FPI rats is 84.35% +/- 0.36%, compared to 83.62% +/- 0.31% for uninjured rats (mean +/- S.D). We have also determined that in the posttraumatic brain: 1) bumetanide, a selective blocker of the Na⁺/K⁺/ 2Cl⁻ co-transporter, did not decrease brain water content (-0.07% +/- 0.08%; n= 5; p=0.14); 2) furosemide, a non-selective blocker of the Na⁺/K⁺/ 2Cl⁻ co-transporter, showed a significant increase in brain water content (+0.32% +/- 0.26%; n=6; p=0.01) 3) barium, a blocker of the K⁺ spatial buffer showed no change in post-FPI brain water content (-0.26% +/- 0.42%; n=5; p=0.24) ; 4) amiloride, an inhibitor of the Na⁺/H⁺ exchanger caused water content increase in the post traumatic brain (+1.25% +/- 0.33%; n=5; p<0.001 and 5) DIDS, a non-selective inhibitor of the Na⁺/ 2HCO₃⁻ co-transporter and the Cl⁻/HCO₃⁻ exchanger showed no effect on the water content of the post-traumatic brain(-0.28% +/- 0.24%; n=4; p=0.08). In summary, we have thus far been unable to find a pharmacological agent that completely eliminates the cytotoxic brain edema in slices from FPI rats. However, more experiments are required to fully evaluate the effects of DIDS and other more selective blockers of carbonate transporters.

MORPHOLOGICAL AND MOLECULAR IDENTIFICATION OF SACCOGLOSSID WORMS OF THE PACIFIC NORTHWEST

SHANNON SMITH, Cellular and Molecular Biology and Zoology, Senior, MARY GATES SCHOLAR,
HOWARD HUGHES SCHOLAR
BILLIE SWALLA, Zoology

Hemichordate enteropneust worms are benthic, intertidal animals with three distinct body parts - an anterior proboscis, a neck region, and a posterior gut and gonad region. We are interested in using hemichordates to investigate theories of chordate evolution. The genus *Saccoglossus* of the phylum Hemichordata is the best known and most studied of the enteropneust worms, but even with this distinction, many species are unknown or uncharacterized. Out of several populations present in the Pacific Northwest, we have found there are two species, *S. pusillus* and *S. bromophenolus*. *S. pusillus* is characterized by a bright orange proboscis, and populations are known in Barkley Sound on Vancouver Island, B.C., in Coos Bay, OR, and in San Diego, CA. *S. bromophenolus* is found in Padilla Bay and Willapa Bay, WA and on the coast of Maine and was most likely introduced to the Pacific Northwest from the East Coast by the oyster industry in the late 19th century. Since molecular data is a reliable tool to distinguish different *Saccoglossus* species (Cameron et al., 2000; PNAS 97: 4469-4474), we have used both 18S rDNA and 16S mtrDNA sequencing to distinguish these two species. In addition to DNA sequencing, we have developed a simple and unique staining method to examine their characteristic gill bars and proboscis skeletons. We have found that the gill bars and proboscis skeleton are cartilaginous structures that may contain type II collagen, the protein found in vertebrate cartilage and notochord. This technique provides an excellent way to compare morphology, which is the widely accepted way of distinguishing enteropneust species.

POSTER SESSION

USING PHOSPHORESCENT DYES TO MEASURE OXYGEN CONSUMPTION IN PANCREATIC ISLETS

MARK STEEDMAN, Pre-Engineering, Junior, MARY GATES SCHOLAR, SPACE GRANT SCHOLAR
GAMAL KHALIL, *Chemistry*
IAN SWEET, *Medicine*

Islet transplantation has proven to be a successful cure for Type I Diabetes. A reliable pre-transplantation islet viability tester has yet to be developed, however. Viability of islets can be determined by measuring their oxygen consumption; healthy islets consume much more oxygen than unhealthy islets. A mechanism for testing islet viability uses a porphyrin-based luminescent dye to calculate oxygen consumption in the islet cells. Dye dissolved in a polymer was injected onto the inside of a small glass chamber, where it hardened into a thin film. Islets were held below the film, and a flow culture system comprised of a pump and gas exchanger was attached to the chamber. An intensity-based lifetime instrument was held to the outside of the chamber, adjacent to the thin film, wherein it measured the oxygen content in the chamber.

ATTITUDES AMONG ASIAN AMERICANS TOWARD THE TOPIC OF ORGAN DONATION

REBECCA SU, Speech Communication, Senior, MARY GATES SCHOLAR
JAMES AH YUN, *Speech Communication*
LISA COUTU, *Speech Communication*

Prior research has examined the topic of organ donation among the Asian American population. Much of this research is descriptive and has focused on the reluctance of this minority group to donate organs. This body of research has revealed that barriers to Asian Americans donating their organs include: 1) religious beliefs; 2) doctor distrust, 3) lack of education; and 4) low community orientation. While this preliminary research has been extremely helpful in describing and understanding the organ donation attitudes of Asian Americans, one limitation to research is that it is merely descriptive and therefore at best provides speculative evidence of the predictive relationships between the attitudes and behaviors of Asian Americans on the topic of organ donation. The goal of this study was to determine if persuasive message type (statistical, narrative, or a message including both statistical and narrative evidence) affect the attitudes of organ donation among Asian Americans. Additionally, this study predicts that prior thought, intent, culture type, argumentativeness, credibility, and the perceived number of people affected, directly or indirectly affect attitudes toward signing organ donor cards. For this study, 100 Asian American participants were partitioned into one of the three experimental message conditions (statistical, narrative, or mixed) and completed a series of Likert type items that measured prior thought, intent, culture type, argumentativeness, credibility, the perceived number of people affected, and attitude toward signing an organ donor card. Analyses of these data will determine the extent to which each of the variables in this study have main or interaction effects on the attitudes toward organ donation among Asian Americans. All of the data for this study have been collected and this analysis is underway.

POSTER SESSION

FUNCTIONAL DISSECTION OF THE HUMAN WERNER SYNDROME RECQ PROTEIN

CRISTINA SWANSON, Biochemistry, Senior, MARY GATES SCHOLAR
RAY MONNAT, Pathology

Werner Syndrome (WS) is an uncommon autosomal recessive disease that mimics premature aging. WS patients also have genetic instability and an increased risk of developing cancer and cardiovascular disease. Werner patient cells in culture show decreased proliferation, genetic instability, and sensitivity to DNA damaging drugs. WS patients were found to carry inherited mutations in the *WRN* gene that markedly reduce or eliminate *WRN* protein production. The Werner protein has two functional domains, a helicase domain and an exonuclease domain, and is thought to be involved in DNA repair and homologous recombination, although *in vivo* functions remain poorly defined. The aim of our research project is to analyze the functional importance of the *WRN* helicase and exonuclease domains in human somatic cells. We constructed plasmid vectors that express different mutant forms of this protein that lack helicase, nuclease, or helicase and nuclease activities. I have transfected these plasmids into Werner patient and control SV40-fibroblast cell lines. Western blot analysis for the *WRN* protein or a linked myc epitope tag was used to identify puromycin-resistant cell clones that expressed the myc-tagged Werner protein. The myc-tagged Werner expression clones will then be assayed for drug sensitivity, DNA homologous recombination, and DNA repair functions. We anticipate that re-expression of the wildtype but not mutant forms of the *WRN* protein in patient cells will suppress the poor growth, DNA damage sensitivity and recombination defect displayed by these cells. It will be interesting to see whether any of these phenotypes that accompany loss of *WRN* protein function can be partially suppressed by forms of the *WRN* protein that selectively lack *WRN* helicase or exonuclease activity. By this approach we hope to better understand the functional domains of the Werner protein at the cellular level, and how the *WRN* protein works to insure genetic stability in human somatic cells. Results of my work may also provide insight into whether the Werner Syndrome phenotype is dictated by the level of expression of Werner protein in cells, and thus how quantitative or qualitative changes in this protein may contribute to the normal process of aging and to important age-associated diseases such as cancer. puromycin-resistant cell clones that expressed the myc-tagged Werner protein. The expression level of the myc-tagged Werner protein in these clones is being determined relative to levels of expression of *WRN* in untransfected control cells. Once myc-tagged Werner expression clones have been verified using the above procedures, they will be assayed for drug sensitivity, DNA homologous recombination, and DNA repair functions. We generated the *WRN* stable expressor clones in *WRN* and control cell lines that contain an integrated pNeoA plasmid that can be used to determine the rate of homologous recombination when wildtype or mutant forms of the *WRN* protein are expressed. We anticipate that re-expression of the wildtype but not mutant forms of the *WRN* protein in patient cells will suppress the poor growth, DNA damage sensitivity and recombination defect displayed by these cells. It will be interesting to see whether any of these phenotypes that accompany loss of *WRN* protein function can be partially suppressed by forms of the *WRN* protein that selectively lack *WRN* helicase or exonuclease activity. By this approach we hope to better understand the functional domains of the Werner protein at the cellular level, and how the *WRN* protein works to insure genetic stability in human somatic cells. Results of my work may also provide insight into whether the Werner Syndrome phenotype is dictated by the level of expression of Werner protein in cells, and thus how quantitative or qualitative changes in this protein may contribute to the normal process of aging and to important age-associated diseases such as cancer.

POSTER SESSION

AUTONOMOUS ROBOTIC MAPPING UNIT

CHRIS TAKAHASHI, Pre-Engineering, Sophomore
WEI-CHIH WANG, Mechanical Engineering

In many situations it is too hazardous or inconvenient for a human to address a task such as mapping an area. The goal of this project is to create an autonomous robotic scouting unit to alleviate this responsibility. Such a robot would be useful for mapping areas such as under ground tunnels or areas where hazardous chemicals or radiation would prohibit a human from doing such a job. In addition to removing the need to risk human life a robot could be much smaller than a human and would therefore be capable of negotiating much smaller spaces than a human being. The robot works by interpreting data from two separate sensor modules. The first module is an array of ultrasonic transducers, which send out a pulse of sound and wait for an echo. This operates much like the sonar on a submarine. The second instrument used by the robot is a digital compass, which can easily be integrated into the robot. This device is used to determine bearing while differences in measurements from the sonar system are used to determine displacement. All data being collected by the robot is in turn fed to a computer via a wireless RS-232 transceiver. These data are interpreted by the computer, which then prints the data on the screen in a form readable by humans. Currently a preliminary design has been made and construction of a prototype is underway.

ROLE OF TELOMERES IN RADIATION INDUCED INSTABILITY

YASUKO TAMURA, Biochemistry, Senior
JEFFREY SCHWARTZ, Radiation Oncology

Chromosome instability is defined as the condition of elevated rates of chromosomal aberration formation. In unstable cells one can find high frequencies of chromosome translocation and chromosomal fusions. Chromosome fusions often involve chromosome telomeres. The high levels of mutations in unstable cells are known to contribute to cancer formation and development. Radiation is known to cause chromosome instability; however, its mechanism is not yet fully understood. In this study we will test the hypothesis that radiation causes chromosome instability by affecting telomere metabolism. We will follow changes in telomere metabolism and function in a human lymphoblast cell line, TK6, under conditions where instability levels have been modified by radiation exposure. In order to study just a single telomere, we are tagging chromosome 7q with a genetic marker. The cells are transfected with a plasmid called pSXPneoD which contains DNA sequences from the end of chromosome 7q. It will preferentially integrate adjacent to the telomere sequence of chromosome 7q. Then Southern blots of DNA samples from each clone will be done using the plasmid as a probe in order to measure telomere size. The insertion of the plasmid has been done and tested to ensure that the plasmid is actually adjacent to the telomere sequence of the chromosome 7q. These cells now can be used to begin our analysis of the relationship between telomere length and chromosome instability. Our first step will be to look at spontaneous changes in telomere length and their relation to chromosome 7q fusions. Our studies should determine what role, if any, telomere changes play in radiation-induced chromosome instability.

POSTER SESSION

UNDERSTANDING USERS OF A HEALTH INFORMATION WEBSITE

ALICE TANADA, Applied Computational and Mathematical Sciences, Senior
JENNIFER TURNS, *Technical Communication*

With the popularity of the Internet, there is a great potential to provide high quality health information to a wide audience. However, users' onsite learning experience may be hindered if the site is poorly structured by their frustration over difficulty of finding the information they need. Consequently, it is imperative to treat information delivery as significant as information content. In order to do this, we seek to understand the site users and audience. The idea of transforming a static informational web site into a more dynamic, knowledge-building community has been the focus of the UW PETTT (Program for Educational Transformation through Technology) "Arthritis Source" project. The Arthritis Source is a medical website providing learners-at-large with information about arthritis. One theme in this research is to determine who the community members are and their needs and preferences, primarily through an online survey completed to date by over 400 participants. I continued with the qualitative analysis of the data obtained from the survey and created a new Emotional and Social Support Coding scheme. The purpose of this coding was to gauge the users' emotional and social support needs in terms of their interaction with the site. A total 10% of users' responses received the maximum emotional support score, suggesting a significant need for emotional support. Only 5% indicated that their social support needs were not met through the site. Motivated by the new coding scheme, the next cross-question analysis used results from the coding to find possible correlations between the state of the users' emotional and social support needs and other factors such as the time of diagnosis with arthritis. The highlight of this analysis was the discovery of ways to improve the site content and the possibility of using time diagnosed to guide patient users in future site-surfing.

GALANIN-LIKE PEPTIDE (GALP) STIMULATES THE HYPOTHALAMIC-PITUITARY-GONADAL AXIS IN THE MOUSE

DAWIT TEKLEMICHAEL, Microbiology, Senior, MARY GATES SCHOLAR, MARTIN FAMILY FOUNDATION SCHOLAR
ROBERT STEINER, *Obstetrics and Gynecology*
DONALD CLIFTON, *Obstetrics and Gynecology*

Galanin is a 29/30 amino acid peptide that acts as a co-transmitter and neuromodulator in the brain. Galanin is thought to mediate its effects through its specific receptors GalR-1, GalR-2, and GalR-3. In December 1999, Ohtaki and colleagues identified a novel neuropeptide Galanin-like Peptide (GALP). GALP is a 60 amino acid peptide in which amino acids 9-21 are identical to the first 13 amino acids of galanin. GALP interacts with GalR-1 and GalR-2 (with higher affinity for GalR-2). GALP neurons projecting from the arcuate nucleus terminate in close proximity to gonadotropin-releasing hormone neurons in the medial preoptic area and the bed nucleus of the stria terminalis in the rat. Since galanin has been shown to stimulate luteinizing hormone (LH) release from the pituitary, and since GALP also activates galanin receptors, we postulated that GALP acting through GalR-2 activates the HPG axis in the male mouse. To test this hypothesis, mice received one intracerebroventricular injection of either GALP (5 nmol) or artificial cerebrospinal fluid (aCSF), and blood was collected thirty minutes later. We measured LH and testosterone levels and found that GALP-treated animals (n=8) had significantly increased serum levels of LH and testosterone ($p < 0.0005$) compared to aCSF controls (n=9). These results suggest that GALP does have a stimulatory effect on reproductive hormones. These effects may be mediated through GalR-2 receptors, or as of yet unidentified specific GALP receptors. The significance of these studies to the field of reproductive endocrinology relies on the necessity of identifying the main players in reproductive physiology. This in turn will allow us to have a better understanding and a clearer picture of the mechanisms by which the brain integrates and processes information that is being channeled via hormones and neuropeptides.

POSTER SESSION

VOCAL COMMUNICATION IN NOCTURNAL MIGRANTS

MARI TOKUDA, Zoology and English, Junior
MARILYN RAMENOFKY, Zoology

Vocal communication between individuals is critical for survival, especially in migratory species. In birds that migrate nocturnally, and cover thousands of kilometers annually, between breeding and non-breeding sites, inter-individual communication is particularly important to coordinate movements within a flock. However, few investigations have focused on vocalizations of birds during migration. Our study addresses a vocalization called the "seeet" call, emitted by the White-Crowned Sparrow (*Zonotrichia leucophrys gambelii*) (WCS) during migratory periods. Historically the "seeet" call has been associated with alarm calls, given to alert others of the presence of a predator. Thorpe (1956) first characterized the "seeet" of the chaffinch (*Fringilla coelebs*) as a low frequency alarm call that is difficult to locate ranging between 6 and 9 kHz. This call is remarkably similar across species. We have identified a "seeet" call in WCS delivered nocturnally during migration. Although the call sounds "seeet"-like, it is distinct from that of the chaffinch alarm call. Sonogram analysis revealed a range from 8 - 10 kHz. The delivery of this "seeet" often occurs in multiple-call series, and may possess multiple tones (harmonics) rather than a single pure tone. Whereas these characteristics make the migratory "seeet" call unsuitable for signal transmission in dense foliage, they are ideal in open landscapes under clear atmospheric conditions, which describes the venue through which migrating birds travel at high altitudes. Currently, we are characterizing the migratory "seeet" call that involves comparison with diel calls given by WCS during the nonmigratory periods. Using registration cages and video cameras to document locomotory activity, we are relating these calls to migratory flight. From this we will correlate behaviors with atmospheric conditions that are conducive to migratory flight. This combined approach investigating vocal communication and migratory behavior provides a novel view of the sophisticated adaptations of nocturnal migratory birds.

PSD-95 IMMUNOREACTIVITY IN HIV-ASSOCIATED DEMENTIA

CHRISTINA TUN, Biochemistry and Neurobiology, Senior, MARY GATES SCHOLAR, HOWARD HUGHES SCHOLAR
GWENN GARDEN, Neurology

Postsynaptic density-95 (PSD-95), a protein also known as SAP-90 (synapse-associated protein-90) is one of a class of proteins found at postsynaptic membrane specializations of the nervous system. PSD-95 is a member of a family of cytoskeleton-associated proteins known as MAGUKs (membrane-associated guanylate kinases) and contains a carboxy-terminal domain, an upstream SH3 domain, and three repeat domains known as PDZ domains. The second PDZ domain binds strongly to the carboxy-terminal tail of NR2 subunits of N-methyl-D-Aspartate receptors (NMDAR) and thus PSD-95 participates in postsynaptic clustering of NMDAR. The clustering of PSD-95 has been associated with increase in number and sizes of dendritic spines. HIV-associated Dementia (HAD) is a neurodegenerative syndrome induced by human HIV-1 infection. HIV-1 does not directly infect neurons, but neuronal injury, dendritic degeneration, and loss of synaptic vesicle proteins have been observed in CNS tissue from HAD patients and transgenic mice expressing the neurotoxic HIV coat protein, gp120. To further study synaptic degeneration in gp120 transgenic mice, we employed PSD-95 as a marker of glutamatergic postsynaptic densities. Cortical tissue sections from wild type and HIV/gp120 transgenic mice were immunolabeled with anti-PSD-95 and analyzed using quantitative deconvolution microscopy. We observed a significant increase in the volume of PSD-95 immunoreactivity in HIV/gp120 transgenic mice. Next, cultured cortical cells prepared from postnatal day 0 mice were treated with 200pM recombinant HIV-1 gp120 for 24 hours, then immunolabeled for PSD-95. Measurements of synaptic area occupied by punctate PSD-95 immunoreactivity also reveal an increase in PSD-95 density after exposure to HIV/gp120. These outcomes suggest that PSD-95 may be regulated by the presence of gp-120. The rise in punctate PSD-95 immunoreactivity in response to gp120 exposure may be a compensatory reaction to dendritic loss or synaptic vesicle degradation, but further study is required to confirm this hypothesis.

POSTER SESSION

CHARACTERIZING INDUSTRIAL ENGINEERING STUDENTS CONCEPTION OF THEIR PROFESSION AND THE ROLE OF CONCEPT MAPS AS AN ASSESSMENT TOOL

MICHELLE VALERIANO, Information Systems, Sophomore, MARY GATES SCHOLAR, SPACE GRANT SCHOLAR
JENNIFER TURNS, *Technical Communication*
ROBIN ADAMS, *Industrial Engineering*

Concept maps represent a practical and intellectually interesting method for assessment in engineering education. In this exploratory research, we probe this idea by having sophomore, junior and senior Industrial Engineering (IE) students complete a word association task followed by a concept-mapping task. Word association task involves writing down all the terms associated with the theme "What is Industrial Engineering?" A concept map is a node-arc representation illustrating the connection and the distinction between groups of concepts. In particular, we sought to understand the relationship between students' conceptions of industrial engineering and how these conceptions compare across different class levels. This data permit us to explore issues such as (a) are there differences in the concept maps across the groups of students; and (b) do features of the concept maps capture student development of expertise in Industrial Engineering? To analyze these issues, we statistically compared the number of overall concepts in relation to their use in the concept map and created physical representations for the terms students generated in their concept maps. We also coded the terms in the word association and concept maps in terms of the following categories: goals of IE, IE technical knowledge, other IE knowledge, generic engineering knowledge, and attitudes or affective issues. We expect that the results will confirm our hypotheses and illustrate the differences among the groups of students. Using these representations, we can clearly illustrate the difference in the groups in terms of integration of professional knowledge, and discrimination of professional IE knowledge and generic engineering knowledge. If the results confirm our hypothesis regarding the differences in the group of students, then concept maps are effective and useful assessment tools in engineering education, which can be used to study other engineering disciplines.

COMPUTERIZED QUALITY OF LIFE AND SYMPTOM ASSESSMENT IN RADIATION ONCOLOGY

ALEXA VELLEMA, Nursing, Senior
DONNA BERRY, *Biobehavioral Nursing*

The purpose of this study was to develop and test the feasibility of a computerized survey method to rapidly identify radiation oncology patients experiencing low function levels in quality of life dimensions and moderate to high levels of distress. Additionally we were interested in the assistance required by elderly individuals. In this descriptive study, outpatients in a radiation oncology setting were studied from February 2001-present. Age and gender were documented. Assistance required was documented January 2002-present. Each participant used a touch screen notebook computer to complete the electronic survey of symptom distress and quality of life within the first week of treatment. The computer program generated a colored graphic report of items, flagging those items that were scored above a level set by the nurses. Copies of the printed output were given to the clinicians. Research assistants counted the number of times patients required assistance during the first eight screens of the program. Through December 2001, 114 patients agreed to complete the electronic questionnaire and 84 (74%) agreed to participate in the research database. Of these, 74 participants (36 women and 38 men) were able to complete the survey. Incompletion was due primarily to clinic time constraints. Responses above the preset cut levels were flagged in red on the computer-generated graph. Nurses utilized the graphic output to focus further assessment and interventions. Eighteen participants ranging in age from 37 to 74 have been evaluated. The number of times assistance was needed ranges from 0 to 8. Correlation will be determined when the data have been collected. We conclude that electronic assessment is feasible in an oncology outpatient setting. To increase completion rates, time must be set aside for routine survey administration prior to the appointment time in the clinic. With the use of this technology, the nurses were able to rapidly identify problems.

POSTER SESSION

ENHANCEMENT OF TIME-OF-FLIGHT SECONDARY ION MASS SPECTROMETRY: OPTIMIZATION IN MOLECULAR ION DETECTION

MARIE VENDETTUOLI, Chemical Engineering and Biochemistry, Senior, MARY GATES SCHOLAR,
SPACE GRANT SCHOLAR

DAVID G. CASTNER, *Bioengineering and Chemical Engineering*

SALLY L. MCARTHUR, *Chemical Engineering*

In the field of biomaterials, one major obstacle is the foreign body response, in which the living system 'walls off' an unfamiliar object by building a layer of tissue around it. The resultant layer of tissue can severely curtail the efficiency of the implanted biomaterial. One proposed solution is to develop biomaterials that mimic the living part they replace more closely. This approach demands that there is a clear understanding of what the environment is at a molecular level. To achieve this end, there is the need for an analysis technique that not only has the sensitivity to look only at the surface layers, but also to correctly identify low concentrations of proteins. One technique that fits these criteria is Time-of-Flight Secondary Ion Mass Spectrometry (ToF-SIMS) which also has a theoretically unlimited mass detection range, perfect to analyze the high molecular weight proteins. Ideally, ToF-SIMS should be able to detect the entire molecular ion. The intent of this research project is to optimize the detection of molecular ions by using matrix molecules. This method has proven successful in sample preparation for related mass spectrometry techniques. It is believed that the matrix somehow changes how energy is transferred to the protein, modifying it in a way that allows the entire molecular ion to be 'lifted' off the surface. So far, experiments indicate that there is a significant increase in the molecular ion signal detected with the use of a matrix. Current research is oriented towards increasing the mass range of detected proteins by using the model Insulin which is larger than the traditionally used protein Angiotensin II and by comparing substrates, including silicon, gold and alkane thiols.

SOURCE MONITORING AND POSTTRAUMATIC STRESS DISORDER

CHANDRA WAJDIK, Psychology, Senior, MARY GATES SCHOLAR

LORI ZOELLNER, *Psychology*

Individuals with posttraumatic stress disorder (PTSD) experience involuntary and intrusive recollections of the traumatic event long after it has occurred. This symptom pattern cannot be attributed solely to the etiologic trauma since the majority of people who experience a traumatic event do not suffer from subsequent, chronic PTSD (e.g., Kessler, 1995). Cognitive processing studies, to date, suggest that individuals with PTSD may process information, particularly trauma-relevant information, differently than those who do not have PTSD (e.g., Foa et al., 1991; McNally et al., 1995, 1997, 1998; Yehuda et al., 1995). Source monitoring, or the ability to avoid blending information (memories) from multiple sources (e.g., thoughts, experiences), is a cognitive processing task that may provide insight about memory representation and retrieval processes. Indeed, elevated source monitoring failures have been detected in trauma survivors with and without PTSD, relative to non-trauma exposed controls (Zoellner et al., 2000). In the present study, our main hypothesis is that rates of source monitoring errors will be elevated in individuals with PTSD, relative to trauma-exposed individuals without PTSD, and non-anxious, non-trauma exposed controls. Participants complete a source-monitoring paradigm, with sentence emotional valence (negative and neutral) as a within-subjects factor. Participants were presented with sentences and then completed a cued recall task assessing memory for words. By comparing the rates of memory intrusions, relative source monitoring performance can be assessed. Data will be presented comparing source monitoring error rates in female assault survivors with PTSD, without PTSD, and non-trauma exposed controls. Results of this study may provide insights about how source-monitoring processes are related to the development and persistence of PTSD symptomatology.

POSTER SESSION

APPLYING THE USE OF ATOMIC EMISSION AND ATOMIC ABSORPTION SPECTROSCOPY TO MEASURE ZINC IN BIOLOGICAL SAMPLES

NADINE WALDMANN, Biochemistry, Sophomore
GAMAL KHALIL, Chemistry
JAMES CALLIS, Chemistry

This research is focused on using atomic emission spectroscopy (AES) and atomic absorption spectroscopy (AAS) as methods to measure zinc in biological samples supplied by the division of endocrinology and diabetes in the Department of Medicine. Atomic emission and atomic absorption are spectroscopic machines capable of determining the amount of a certain metal (or metals) in a given sample. It is anticipated that these methods will be used as an indirect way of assessing insulin in pancreatic islets, thereby making it easier and faster to determine their viability for transplantation in diabetic patients.

EXPLORATORY DEVELOPMENT OF ENVIRONMENTAL MICROCHAMBERS MODULES FOR GENOMIC RESEARCH APPLICATIONS

MICHAEL WANG, Pre-Engineering, Sophomore
KELLY A. FITZGERALD, Chemical Engineering
MARK R. HOLL, Electrical Engineering
VEGA SUBRAMANIAM, Early Entrance and McNair Program

The Microscale Life Sciences Center (MLSC) at the University of Washington has a central goal to develop integrated biologically-active microsystems comprised of miniature-scale modules with microscale functionality. Ultimately, these integrated microsystems are intended to allow applications specialists to probe gene expression in living cells at the single cell level. In order to probe cellular function at the single cell level it is necessary that stable microenvironments be maintained for cells of interest. Simultaneously, it is important that the microenvironment also be designed to enable effective detection of gene expression (either up or down regulation) in real-time as a function of environmental changes made by the researcher. As an exploratory effort within the Genomation Laboratory, we are designing a set of modular microenvironmental chambers of varying chamber volume and geometry, but having identical thermal and growth media delivery characteristics. Our initial efforts will examine simple growth characteristics of a methylotrophic bacterium *Methlobacterium extorquens* AM1. AM1 is a rod shaped bacterium ~1 μm in diameter that grows to a full length of ~6 μm with a 6 hour division cycle time. Newly divided bacterium are ~3 μm in length. These cells require a sterile ~30 C microenvironment and good perfusion of growth media with uniform O_2 and CO_2 concentrations. Temperature, and flow rate of growth media will be controlled for a 3 day experiment. Images will be collected and growth rates will be plotted as a function of time. Light exposure will be minimized while performing cell counts in order to avoid thermal shock.

POSTER SESSION

AGENDA SETTING: WHO SETS THE PRESIDENT'S AGENDA, THE PRESIDENT OR THE PUBLIC?

JASMIN WEAVER, Philosophy, Political Science, and Community and Environmental Planning, Senior
MARY GATES SCHOLAR
BRYAN JONES, *Political Science*

Who sets the president's agenda, the president or the public? A great deal of research has been done about how issues get on the public's agenda, but far less has been done about how issues get on the president's agenda, and if there is a causal relationship between the two. In this project I use State of the Union Addresses to measure the president's agenda, and I use two factors to measure the public's agenda: the Most Important Problem Poll given by Gallup, and New York Times stories. I have compiled and codified the State of the Union Addresses myself, while my data on the other two variables will come from the Policy Agendas Project database created by UW's Center for American Politics and Public Policy. I examine, for the years 1947-2000, whether the public's agenda (measured using the factors above) influences the president's agenda, or vice versa. More specifically, I look at whether State of the Union Addresses reflect concerns already raised by the public, or whether the president's focusing on an issue in a State of the Union Address puts it on the public agenda. The little research that has been done in this area suggests that the more a president focuses on a policy area in his speech, the more important the public thinks that policy area is. I expect to confirm this result, but also to find that the more the public is already concerned about an issue, the more time the president will devote to it in the State of the Union Address.

DETERMINING CYANOBACTERIA, PICOEUKARYOTE AND NANOFLAGELLATE ABUNDANCE IN THE GULF OF ALASKA USING EPIFLOURESCENCE MICROSCOPY

COLLEEN WEISER, Biology: Ecology, Evolution, and Conservation, Senior, MARY GATES SCHOLAR,
SPACE GRANT SCHOLAR, HOWARD HUGHES SCHOLAR
EVELYN LESSARD, *Oceanography*

One of the largest fisheries in the world is located in the Gulf of Alaska, supported by its incredibly rich ecosystem. Our lab went on three research cruises (April, May, June, July 2001) to study this ecosystem. We were interested in studying the base of this system, focusing on photosynthetic cyanobacteria, picoeukaryotes and nanoflagellates. Cyanobacteria are of particular interest in this region because it was thought that these organisms typically thrive in warmer, nutrient-poor regions. We wanted to study how these organisms were distributed geographically across the Gulf of Alaska, with depth and temporally. Samples were collected along the Seward Line (GAK Stations 1-13) at varying depths using 5L Niskin bottles. They were fixed with gluteraldehyde, filtered and stained with DAPI. Samples were then mounted on slides and frozen to preserve fluorescence of cells. The three organisms were counted using an epifluorescent microscope at 1,000X magnification using low viscosity oil and blue light. The cell counts were converted to cells/ml using a spreadsheet and spatial graphs were created for each organism at the different depths. As expected, picoeukaryotes, cyanobacteria and unidentified nanoflagellates were more abundant in surface waters than deep waters. Surprisingly however, cyanobacteria were found to be very abundant and are potentially important in this cold, nutrient-rich region. Cyanobacteria and picoeukaryotes were much more abundant in May than in April, possibly due to changes in many factors like solar insolation, nutrient levels, growth and grazing rates. There are several apparent trends of abundance which should be investigated further. Cyanobacteria increased from inshore to offshore while picoeukaryotes and the unidentified flagellates were more uniformly abundant across the Gulf of Alaska. This information has potential applications in understanding the entire food web in this region and may aid in developing a model for juvenile Pink Salmon as part of the Global Ocean Ecosystems Dynamics (GLOBEC) project.

POSTER SESSION

HISTORICAL CHANGES IN ISSAQUAH CREEK: HISTORICAL RECORD AND ITS ROLE IN STREAM REHABILITATION

JON WHISLER, Geological Sciences, Senior
DAVE MONTGOMERY, Earth and Space Sciences

The flood plain Issaquah Creek provides evidence of dramatic transformations of both the channel and the surrounding watershed. Stratigraphic evidence preserved in the valley-bottom terrace identifies several phases of channel change that can be associated to a historical timeline through radiocarbon dating and historical records. A basal layer of clay underlying the entire flood plain constrains the early Holocene river level. Historic photographs shown that the terrace surface that forms the contemporary valley bottom formed the historic floodplain in the early 20th Century. A permanent drop in the level of Lake Sammamish ca. 1916 resulted in incision of Issaquah Creek by 3 m. At present the Creek is eroding the higher surface of the abandoned floodplain and depositing a new, lower elevation floodplain in the wake of laterally migrating meanders. A prominent deposit of coal debris in the sediment record records the impact of early mining during the period of 1870 to 1887. This deposit also marks a distinct change in the grain size of the bed load from gravel to sand. Based on this stratigraphic marker, the long term accumulation rates of sediment on the Issaquah Creek floodplain times increased during the late 19th and early 20th Centuries by approximately 100-fold over long-term Holocene rates. Early written reports and newspaper accounts document concern over both aggradation in Issaquah Creek and the impact of the coal mining operations on the salmon fishery. Assessment of historic land use records shows that the period of aggradation coincides with greatly increased agriculture, timber and mining in the watershed. The extensive historic changes on Issaquah Creek provide a context within which to evaluate the potential for restoration and rehabilitation efforts.

KEEPING FOUND THINGS FOUND DESIGN

AMANDA WHITTY, Informatics, Senior
KHOI DUONG, Informatics
DAVID McDONALD, Informatics
WILLIAM JONES, Informatics

The problem of information retrieval—the need to find information from a large set of possibilities—has been a problem studied by information professionals spanning across numerous retrieval tools and techniques. With the addition of the Internet as an information resource, this problem has become increasingly complicated. An extension of this problem is how people organize found information for re-access and re-use without repeating the finding process. Based on an initial study by the Information School's Keeping Found Things Found (KFTF) group, we designed and evaluated a Web information manager through a two phase process. The initial prototype was a revision of the commonly used web information manger, Add Favorite, in Internet Explorer. The development and evaluation of this prototype determined if the revision better met the needs of users than the current browser tool. In addition, it incorporated methods to address information saving needs found in the KFTF preliminary research that includes the ability to e-mail information, the ability to save outside of the Favorites folder, and the ability to provide a description to a “favorite”. In a User-Interface Evaluation of this prototype, participants addressed issues with the methods available and provided suggestions for additional methods. Overall, users felt the additional methods were useful and were hindered only by some problems of ambiguity related to the interface. A final prototype, which is currently under development, will provide methods from the initial prototype and additional methods including the ability to search saved Web information.

POSTER SESSION

A QUESTION OF COLONIZATION: A LITHIC ANALYSIS OF TANGINAK SPRING SITE, SITKALIDAK ISLAND, ALASKA

LESLIE WIDNER, Anthropology, Senior
***BEN FITZHUGH**, Anthropology*

Understanding hunter-gatherer colonization events should help us to better understand some of the breadth of human adaptation to a variety of environments and the processes that occur as people move into new landscapes. Although analysis of colonization using the archaeological record is difficult, some of the problems that archaeologists studying colonization by prehistoric hunter-gatherers, want to solve are: How far were hunter-gatherers willing to travel to procure food and/or raw materials? How do colonists deal with variably reliable materials? How does maintenance difficulty effect raw material selection? Here, I will report results from a careful analysis of lithic raw materials collected during excavations at the Tanginak Spring site (KOD 481). This site is located on Sitkalidak Island, part of the Kodiak Island grouping in the Kodiak Archipelago. Kodiak settlement dates from approximately 7,500 years ago and is called the Ocean Bay Tradition. Tanginak Spring, a stratified site spanning 1500 years of occupation and one of the oldest known occupation sites, was the focus of archaeological investigations conducted between 1998 and 2001 under the direction of Dr. Ben Fitzhugh. My question: If new colonists established the bottom level of the Tanginak Spring site, then these colonists would have imported higher quality lithic raw material and increasingly exploited local materials as time went on. To test this hypothesis I have done a detailed count of lithic debitage raw materials where lab analysis should show a decrease through time of the imported materials and a concurrent increase of locally available materials.

STUDENTS' PERCEPTIONS ON TECHNOLOGY USED WITHIN THE CONTEXT OF A COURSE

ADAM WINGARD, Sociology and Business, Senior
***SCOTT MACKLIN**, Program for Educational Transformation through Technology*
***KIMBERLY GUSTAFSON**, Program for Educational Transformation through Technology*

Technology has been presented as an effective method to improve teaching and learning, yet few researchers have examined the student's perception of technology and its use within the context of a course. Prior research has primarily focused on showing a causal link between the use of a particular technology and student learning, while other research has focused on student's perceptions of technology and how they believe the technology added to or subtracted from their learning experience. Furthermore, even less research has relied on students themselves to define both technology and their learning experience. This exploratory study will utilize focus groups and survey research to understand student's perceptions of technology, the affect of those technologies on their learning environment, and how these perceptions vary across race, gender, major and class standing if they do at all. Findings from this study will be used to promote future research, develop the use of technologies within courses that students feel increase their learning and facilitate the development of pedagogical methods within the context of a university setting.

POSTER SESSION

GERMAN FILMMAKERS IN EXILE

JANNA WOHLLEBEN, International Studies, Senior
ERIC AMES, Germanics

During the 1930s artists, writers, and filmmakers were among the vast number of German Jews forced to leave Germany under the leadership of Hitler and the National Socialist Party. A large number of those from the German film industry made their way to Hollywood. For some, the trauma of having to flee their homeland would be an experience that would stay with them forever. My focus in this project is on German filmmakers in exile, and on the work of Curt Siodmak in particular. I propose that by examining the writings and films of exiled writer Curt Siodmak one can see how he expressed the fears and anxieties-- the sense of dislocation, disillusionment, and alienation-- prevalent among German exiles in Hollywood. My work is part of an ongoing undergraduate project focusing on the cultural history of German cinema--a project designed to gather information for an on-line database that will give students and instructors an interactive tool for research and teaching.

EXPERIMENTAL CHARACTERIZATION OF COMPUTATIONAL SEQUENCE REDESIGNS OF SMALL NATURALLY OCCURRING PROTEINS

MICHELLE WONG, Biochemistry, Senior
DAVID BAKER, Biochemistry

The amino acid sequence of a protein determines its three dimensional structure as well as its function. By altering the amino acid sequence of a protein, these characteristics are also changed. Within the lab, computational methods are being developed to rationally redesign the sequence of naturally occurring proteins, while maintaining their over-all 3D structure. Given our current understanding of protein structure, it should be possible to use these methods to redesign small proteins to be more thermodynamically stable than their naturally occurring counterparts. My project involves the expression, purification and experimental characterizations of computational sequence redesigns of two small naturally occurring proteins: the C-Src SH3 domain and protein L. I have successfully expressed and purified the redesigned SH3 domain and I will determine the stability of this protein in the near future by using circular dichroism spectroscopy. Redesigned protein L has been previously shown to be more thermally stable than the wild type protein, and I am currently trying to grow crystals of this protein in order to solve its 3D structure using x-ray crystallography.

HOW A POOR COUNTRY CAN BE RICH

HENDRA LAKSANA WIDJAJA, Economics, Senior
ANIL DEOLALIKAR, Economics

The objective of this study is to examine factors that are very important for a country to grow. I am focusing on Indonesia as an example in my current research. Over the years, many economists have asked the question, "Why are we so rich and they are so poor." In seeking an answer, economists have used data from many countries to develop the best model. From that model, they can categorize a country as being poor or rich. For the past six months, I have worked in my honor thesis investigating China's economic growth, which has occurred rapidly since its open door policy in 1978. I analyzed China's statistical data to find the answer and found many foreign direct investments coming into China. Those investments boosted its economic growth. To determine whether or not foreign direct investment is also a key factor for Indonesia's economic growth, as it has been for China, I am gathering data pertaining to Indonesia's historical growth rate of domestic product in order to perform analyses and am relating my analyses to what some economists identify as common factors necessary for a country to grow.

POSTER SESSION

SPECIFIC ASSOCIATION OF THE SYNTROPHINS WITH MULTIPLE DYSTROPHIN BINDING SITES

JEAN YOO, Neurobiology, Senior
STANLEY FROEHNER, *Physiology and Biophysics*
DOUGLAS ALBRECHT, *Physiology and Biophysics*

The dystrophin complex is a system of proteins that is critical in stabilizing the muscle membrane during muscle contraction. Mutations of the dystrophin gene are responsible for Duchenne and Becker Muscular Dystrophy which affect over 1 in 3,500 males. Recently, dystrophin has also been discovered to be a scaffold for signaling molecules. Syntrophins, one of the several dystrophin-associated proteins, are modular adapter proteins that bind dystrophin and recruit signaling proteins such as neuronal nitric oxide synthase to the complex. There are five syntrophin isoforms that have distinct cellular and subcellular distributions. Therefore, the specificity of binding and interaction of syntrophin with the dystrophin complex is critical for the characterization of the dystrophin complex as a signaling scaffold. The focus of this project is to determine if the syntrophins specifically bind to the first, second or both of the syntrophin binding sites (SBS) in the C-terminal domain of dystrophin. We produced GST fusion proteins containing the syntrophin binding sites in dystrophin and incubated them with brain or liver homogenates enriched for syntrophin. Western blots of these GST pull downs were performed to determine whether individual syntrophin isoforms preferentially bind to one or both of the SBSs of dystrophin. Our data indicate that α -1, β -1, and β -2 syntrophin can bind to both SBSs in dystrophin and that γ -1 and γ -2 syntrophin selectively bind only the first SBS. With these results, we can conclude that the γ -syntrophins associate with dystrophin through an interaction mediated primarily if not entirely by the first SBS on dystrophin. The presence of this site in dystrophin is potentially regulated by alternative splicing which provides a mechanism to modulate the association of the γ -syntrophins and their ligands with the dystrophin complex.

CHARACTERIZATION OF THE HELa CELL HOMOZYGOUS DELETION ON CHROMOSOME 11Q13: POSSIBLE RELATIONSHIP TO THE HERITABLE FRAGILE SITE FRA11A

KAYVAN ZAINABADI, Molecular, Cellular and Developmental Biology,
Senior at University of California, Los Angeles
HOWARD HUGHES SCHOLAR, AMERICAN ASSOCIATION FOR CANCER RESEARCH FELLOW
ERI SRIVATSAN, *Surgery, University of California, Los Angeles*

Restriction fragment length polymorphism (RFLP) mapping studies have identified deletion of chromosome 11q13 sequences in cervical, breast, endocrine and other tumors. We have recently identified a homozygous deletion of 11q13 sequences in the HeLa cells (a cervical cancer cell line) and in a primary cervical tumor. We have sequenced 175kb of the area encompassing the HeLa homozygous deletion and have mapped the deletion to a 5.7kb interval. To identify the deletion breakpoints, we performed PCR analysis using primers flanking the deletion. Instead of an expected 7.7kb PCR product, HeLa cells and two HeLa cell derived tumorigenic hybrids yielded a 2kb product, confirming the presence of a 5.7kb homozygous deletion. Two normal fibroblasts contained both the 7kb and 2kb products. These two samples have undergone a hemizygous deletion of 11q13 sequences. The deletions were confirmed by Fluorescence in-situ hybridization (FISH) using 11q13 specific probes. Sequencing of the 2kb products showed a 150bp repetitive LINE1 sequence at both the proximal and distal ends of the deletion. This suggests that the deletions are a result of genomic recombination due to the presence of the LINE1 elements. Abundance of other repetitive sequences at this site and deletion in normal samples further suggest that this locus represents the 11q13 fragile site, FRA11A. The HeLa cell homozygous deletion also defines the presence of a tumor suppressor gene at this site. Fragile sites are shown to be involved in the development of tumors, as well as in mental retardation and neuromuscular diseases. At present, we are cloning the putative tumor suppressor gene from this locus.

POSTER SESSION

MIMICKING A VIRUS...NONVIRAL GENE THERAPY WITH pH-SENSITIVE, SYNTHETIC POLYMERS

JASMINE ZIA, Bioengineering, Senior, MARY GATES SCHOLAR

ALLAN HOFFMAN, *Bioengineering*

CHARLES CHUENG, *Bioengineering*

Inefficient gene delivery of DNA has prevented the field of gene therapy from expanding its wide range of potential medical applications. One of the main obstacles at this point has been the ineffective endosomal release of the delivery vector upon its entrance into the cell. To increase gene delivery efficiencies, modifications to both viral and nonviral vectors have been attempted. In this study, we used nonviral vectors consisting of three components: a cationic lipid agent (DOTAP), a plasmid DNA encoding for the enzyme β -Galactosidase, and membrane-disruptive, pH-sensitive, synthetic polymers. The effectiveness of cationic lipid agents in enhancing cellular uptake has already been emphasized in previous studies, therefore we focused our research primarily on the endosomal-disruptive efficacy of three pH-sensitive, synthetic polymers: poly(methylacrylic acid)(PMAA), poly(ethylacrylic acid)(PEAA), and poly(propylacrylic acid)(PPAA) by means of a hemolysis assay and a transfection efficiency assay [1]. In the hemolysis assay, we investigated the effect the polymer concentration and pH had on the hemolytic activity of our samples. In the transfection efficiency assay, we investigated the effect the polymer concentration, the charge ratio of the particles and the presence of serum had on the transfection efficiency of our samples. Based on our results, we found PPAA as the most effective polymer tested. Upon this conclusion, we then focused the remainder of our study on the optimal formalization of our delivery vector with PPAA by varying the salt concentration and mixing order of our vector components.

REDUCED DIMENSIONAL ADSORBATES ON CARBON NANOTUBES

DANIEL VANDERVELDE, Physics, Junior, MARY GATES SCHOLAR

OSCAR VILCHES, *Physics*

I have been researching the characteristics of adsorption of hydrogen and oxygen on carbon nanotubes, and the characteristics of these gases after being adsorbed. This experiment has been under my own control, with the guidance of my faculty mentor and a graduate student. This will take place on a self-designed DC calorimetry cell placed in a liquid helium four-probe cryostat which I have been refurbishing. The cell should be able to take readings for temperatures of approximately four Kelvin and up. Possible outcomes of this experiment include observation of both one-dimensional and two-dimensional substrates that would be located in the interstitial spaces and on the surface of these nanotubes respectively. This could lead to the measurement of a one-dimensional heat capacity of $k/2$ in the case of the interstitial spaces, further observation of single or multiple layer substrates on a curved surface, or perhaps an efficient, non-volatile method of storing hydrogen for use as a fuel.

PRESENTATION SESSIONS

“I happen to work with a professor who is very interested in encouraging undergraduate research. He is very generous with both his time and resources.”
- Senior, Electrical Engineering

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Session Moderator: Patrick Rivers, American Ethnic Studies

Student Moderator: Jasmine Weaver, Philosophy and Political Science, Senior

SESSION A:

ASSESSMENT OF ONLINE POLITICAL PARTICIPATION OF FREE SPEECH ISSUE

SAYAKA KAWAKAMI, Communications and Political Science, Senior

DAVID SILVER, *Communications*

Today, the Internet increasingly plays an important role in American politics. Many advocates of information technology say that the Internet enhances democracy, encouraging citizens to act politically and to exchange and express ideas in society. The question I pursued was whether political websites fostered significant action -- online or offline -- on the part of the sites' visitors. In other words, do political websites provide opportunities for users to apply information and interaction in significant ways to contribute to the political process? In this web-presented project, I looked at how political sites on free speech, one of the basic rights of U.S. citizens, play a role in cyberspace, and whether the role actually encourages people to participate in the political process. First of all, I developed three types of "Online Political Participations": Direct Online Participation, Indirect Online Participation, and Political Discussion Engagement. Then, I used Google, a popular search engine, to locate websites of free speech issues and picked the first twenty sites for assessment. Using a particular set of criteria, each site was evaluated on the basis of usefulness, relevance, interactions, and participation. Finally, I compared and contrasted all twenty sites for further analysis and to draw conclusions. My findings showed several interesting tendencies of political websites. In terms of using a search engine for locating sites, it is not helpful for citizens to find sites that have a great amount of useful information or that provide a place for political participation. Most importantly, those twenty sites did not provide significant places for political discussion. Some sites are not really informative at all. Others have a large amount of information, but do not allow people to express opinions or to be actively involved in free speech.

ONLINE HUMAN SUBJECTS RESEARCH: A CHALLENGE TO TRADITIONAL RESEARCH GUIDELINES OR NOTHING NEW?

JENNIFER HAGMAN, Informatics, Senior, MARY GATES SCHOLAR

HARRY BRUCE, *Informatics*

PETER KAHN, *Psychology*

BATYA FRIEDMAN, *Informatics*

This study investigates the protection of human subjects provided in the research of online interactions -- in which researchers use chatrooms, discussion forums, listservs, and other similar venues to study individuals and communities online. Online methods have become increasingly prevalent over the last several years and provide researchers a unique opportunity to employ covert observation, participatory methods, or a combination of the two. Entire communities' and individuals' interactions can be observed simultaneously. Subjects from all areas of the world are easily accessed. Data collection is simple and inexpensive. Often, messages are archived, making users' postings available indefinitely. For the first time, researchers have the ability to observe human subjects and their interactions while away from the physical presence of these individuals. Online research seems to alleviate many of the difficulties omnipresent in offline studies. Yet when traditional ethical and legal human subjects guidelines such as those set forth in The Belmont Report (1979) are taken into consideration, are online participants being adequately protected? Most Institutional Review Boards (IRBs) allow researchers to conduct studies of online interactions without honoring many of the foundational applications that protect participants in offline research, such as informed consent. This is often under the presumption that information on the Internet is publicly

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available. Nevertheless, online participants can frequently be linked to offline identities, breaching the ethical obligation of confidentiality. This research study involved interviewing researchers and IRB professionals to develop insight into the issue of human subjects protection for individuals engaged in online interactions. The purpose of this presentation is to report the project findings, including where the researchers and IRB professionals interviewed think traditional research guidelines should be honored, where they fall short, and whether research of online interactions fits the traditional framework for human subjects protection or brings forth new complications.

SELF-DISCLOSURE ON THE INTERNET: EXAMINING THE MOTIVATIONS AND CONSEQUENCES BEHIND PERSONAL REVELATIONS IN A PUBLIC SPHERE

JEANNY MAI, Communications and Psychology, Senior
DAVID SILVER, *Communications*

In the last few years, online journals (diaries) have become among the most widespread of Internet applications. They generally contain considerable personal information about the writers, their friends and families. The startling proliferation of online journals begs the question: What inclination would one have to expose their most private thoughts and experiences for a public and broad audience? Previous research suggests that the amount of self-disclosure on personal websites stems from qualities unique to the Internet. Temporal asynchronicity affords designers ample time in creating sites and also protects them from more direct avenues of rebuff and criticism (Cheung, 2000). Other studies suggest that the Internet allows people to create multiple “selves” that can be more accurate, by incorporating aspects which may not be acceptable to other people or fantastic, due to the ease of opening another web browser to house a new personality (Turkle, 1995). This study seeks to profile a number of these online journalers (alternatively called “diarists” or “bloggers”), through examining the sites and their design, content and (writing) style, and the writer’s motivations and thoughts behind their purpose. This multi-methodological research project is based on ethnographic research on content analysis, as well as a unique framework of interface design. Results thus far state one’s need for a space or home online. In a medium where choices abound without any clear paths to take, these individuals have partitioned a place which they can safely call their own. Beyond this there are varied, personal reasons such as healing from trauma or abuse, reaching out to other people, and voicing an opinion which may otherwise go unsaid.

SESSION B:

BRIDGING THE DIGITAL DIVIDE: POLICY FOR PEACE IN THE INFORMATION AGE

MARGARET-AMELIA ELHAM SIMMONS, Senior, MARY GATES SCHOLAR
JOANNE HO, International Studies, Senior, MARY GATES SCHOLAR
KIMI KAWABORI, International Studies, Senior
JACKIE SCHULTZ, International Studies and Political Science, Senior
ANNA YORK, International Studies, Senior
DEBORAH WHEELER, *International Studies*

This task force lays the foundation for United States interests, including that of creating a more peaceful world, which we believe can only be accomplished through bridging the digital divide. To execute our intention we find it necessary to first understand the reoccurring obstacles in closing the gap between the information haves and have-nots, as they apply to each situation. This, in turn, enables a more effective method for U.S. foreign policy to implement appropriate solutions. The growing trend of disproportionate access to ICT – emerging along various regional, economic, political and social lines – moves to the forefront of world concern as an issue that must be addressed for continue development, under the label “Digital Divide”. Rather than an abstract, generalized

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representation of the structure of the digital divide, this task force recognizes that to fully understand this multifaceted issue, it is necessary to use several levels of analysis. The cultural, institutional, and socio-economic levels of analysis integrate a comprehensive approach to the structures and methods available for bridging the digital divide. Our method divides this analysis into four sections. To begin with, "Conceptualizing the Digital Divide" addresses democracy and national security, gives a background of the "Digital Divide," provides an assessment of countries in terms of e-readiness and analyzes local, national and international stakeholders. The second section, "Social, Political and Economic Institutions" seeks to understand the roles of regulatory agencies and transparent government policies, government role in infrastructure, the promotion of education, microfinance, the private sector and the military. In the third section, "Cultural Barriers" examines the need to develop sensitive and appropriate technologies, taking into consideration religious, political and socio-economic contexts. To conclude, the case studies provide examples of successful ICT integration in three developing countries: The United Arab Emirates, Bangalore and Singapore.

RESOURCE EXHAUSTION TOLERANCE AND DISTRIBUTED USER AUTHENTICATION IN GROUP COMMUNICATION

ANATOLIY IOFFE, Electrical Engineering, Senior
RADHA POOVENDRAN, *Electrical Engineering*

The shift toward wireless networks in commercial and military applications introduces the need to develop efficient security algorithms that achieve information transfer security, user and node authentication, and network stability protection from malicious disruptions. These challenges of the ad-hoc nature of wireless networks motivate and bridge together my research goals: Distributed Denial of Service (DDoS) Tolerant Networks and Distributed Biometric Sensor Authentication. Denial of Service (DoS) attacks are not new to the Internet community. Unfortunately, the number and methodology complexity only increase. Recent developments in DoS technology have shown that existing tools are not sufficient in combating the threat. The advent of a new breed of highly scalable algorithms resistant to established practices of network defense is an alarming trend. This project shows that current defenses relying on IP trace-back and static filtering are not a sufficient defense and analyzes existing real-time policy-based filtering schemes. The project's goal is to develop a prototype filter, which relies on statistical evaluation of IP traffic in real-time to recognize and discard offending flows which constitute an attack. Research into Distributed Biometric Sensor Authentication is motivated by the use of handheld wireless devices, which are often part of a distributed group network. These devices rely on the use of biometric techniques to ensure that only the permitted users have access to the device's capabilities and group membership. The wide availability of biometric devices removes the constraints of the project to the development of a customized biometric node and biometric server network. In this setup, the biometric node must be able to easily join the network with the biometric server, it must obtain user feature data from its biometric device, and it must carry out the server's user access policy. The project's prototype design will be assembled on a programmable microcontroller development kit.

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DEFENDING THE UNITED STATES AGAINST NEW THREATS, FOREIGN AND DOMESTIC

GRAYDON MULLER, Astronomy and Physics, Senior
VLADIMIR CHALOUPKA, Physics

The role, structure, and procedures of the United States military are centered around conventional armed conflict with an adversary representing a nation-state, or (recently) a large terrorist organization. The spectacular advances in science and technology - physics, computer science, molecular biology - bring new and fundamental dangers against which we must defend. The most critical of these dangers is that of "knowledge-enabled mass destruction". This is a term coined by Bill Joy to describe the low level of resources, and thus the much greater accessibility to these weapons, needed to inflict terrible destruction, even human extinction, through either intentional or accidental misuse. To date, disturbingly little has been done to explore or prepare for these threats. Some papers have been written which act as good warnings, but a more concrete course of action, based on the facts known, must be determined. In this talk, the role that the United States military could/should play in defending against the new technological threats will be discussed. This study is supervised by Professor Vladimir Chaloupka, but the opinions expressed are those of the author, an ROTC Cadet with a philosophy background majoring in both Astronomy and Physics.

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Session Moderator: David Domke, Communications
Student Moderator: Mari London, Communications, Senior

ARE YOU JOKING?: ADOLESCENTS' INTERPRETATIONS OF THE EMOTIONAL CONTENT OF APPEARANCE-RELATED TEASING

SHENNA BAUTISTA, Psychology, Senior, PRESIDENTIAL SCHOLAR
DIANE CARLSON-JONES, Educational Psychology
GABRIEL GALLARDO, Early Identification and McNair Scholar Program

Adolescents may interpret teasing comments on appearances to be hurtful, funny, or both, and the effects of this type of teasing may negatively affect their self-esteem and body image. Gender and relationship of the teaser may also affect adolescent's perceptions on teasing. The purpose of this study is to assess how gender, appearance topic, and relationship affect adolescents' interpretations of the emotional content of hypothetical teasing comments. One hundred and fifty-nine sixth- and eighth-grade students completed questionnaires consisting of different hypothetical appearance-related teasing scenarios. They rated the positive and negative emotional responses to the scenarios. Results are discussed in terms of the importance of gender and relationship for the interpretation of teasing comments during adolescence.

ETHNOGRAPHIC STUDY OF CANCER PATIENTS IN SRI LANKA

CHAMI ARACHCHI, Anthropology and General Studies: Public Health, Junior
JAMES GREEN, Anthropology
CLARKE SPEED, American Indian Studies

This is a study conducted in Sri Lanka's first and only cancer hospice during the summer of 2001. I began this study in order to examine the concepts of suffering and pain in Sri Lankan cancer patients, in a developing world medical system. I conducted ethnographic research, which consisted of personal interviews with patients, administration and employees of the hospice. Coupled with socio-cultural understanding of cancer care, this research intends to understand the influence of a Western institution (the hospice) in an Eastern medical system. Furthermore, this study addresses the issue of stigma that Sri Lankan cancer patients experience upon their diagnosis. During the interviews it became evident that doctor-patient relationship existing in Sri Lankan culture was vastly different from the doctor-patient relationship existing in the United States. Cancer patients talked in depth about their immense respect towards the physicians, and they believed and valued the physicians' word without questioning. Patient consent for medical procedures was non-existent in Sri Lankan culture. The physician continued his/her dialogue about a patient's medical status not with the patient, but with the patient's male relatives or friends. In Sri Lankan culture, one's body was not considered to be an individual commodity, but was a commodity of the entire community which the person operates in. When a person was diagnosed with a life-threatening illness, such as cancer, not only did it affect the particular individual, but the entire community he/she operated in. The differences in doctor-patient relationships existing in Sri Lanka indicate the concept of considering one's body as a collective vs. individual commodity in this social setting.

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COULD EMPOWERMENT BE THE ULTIMATE SOLUTION TO URBAN POVERTY?

OLIVIA CALDERON, Political Science and History, Junior at University of California, Los Angeles,
MCNAIR SCHOLAR, WASSERMAN SCHOLAR

JACQUELINE LEAVITT, *Urban Planning*, University of California, Los Angeles

In 1993, the Clinton Administration and the Department of Housing and Urban Development introduced the Empowerment Zone and Enterprise Community (EZ/EC) program hoping to alleviate severe poverty conditions within inner-city neighborhoods. The program was designed to empower residents of poverty-stricken communities across the nation by inspiring them to work together to create jobs and opportunities, and by bringing together in a focused concerted effort Federal Tax incentives and funding, state and local government funding, and community planning. My research proposes to examine the issue of inner-city poverty and community empowerment from the perspective of Empowerment Zone legislation, in order to answer the following question: does the Empowerment Zone and Enterprise Community (EZ/EC) program actually help solve long-standing urban problems by "empowering" the community? A comparative case study approach is used to compare and contrast program outcomes in Atlanta, Baltimore, Chicago, Detroit, New York, and Philadelphia/Camden. Data on program outcomes will be collected from official statistical sources and from a review of empirical literature. Level of community empowerment will be assessed through the measurement of the levels of community members' political involvement. Research on poverty fighting strategies is necessary to prevent further policy damage to inner-cities. An understanding of the factors of success and or failure of the Empowerment Zone and Enterprise Community Program will provide valuable insight for policy recommendations that effectively target the causes of poverty. Most certainly, it may well be that conservative policy makers that undercut support for social programs and shun the idea of empowerment will realize that empowerment strategies can revitalize, rejuvenate, and revolutionize inner-cities.

ROLE OF HISPANIC FAMILIES AND BUSINESSES ON THE ECONOMY OF WASHINGTON STATE

AMY LOFTIS, Business Administration and Anthropology, Senior, GATES MILLENIUM SCHOLAR, MCNAIR SCHOLAR

MICHAEL VERCHOT, *Business and Economic Development*

PAMELA BOYLE, *McNair Program*

When the 2000 U.S. Census results were released in March 2001, a flurry of reports in local and national newspapers expressed astonishment at the growth of the Hispanic population since the 1990 census. This ethnic group in Washington State doubled to 441,509 and now account for 7.5% of the state's population. One possible reason for this seemingly substantial growth is previous undercounts, but what has resulted from this unexpected growth is the need for better information on Hispanics in Washington State. Information is scattered throughout various sources, which makes it difficult to analyze this community and its economic contributions. The objective of this research is to look at both popular media and governmental resources to understand the economic contributions of Hispanics in Washington. Currently, this ethnic category accounts for 7.5% of the state's population. However, their buying power only accounts for 3.5% of the state's total, educational attainment is lower at all levels, Internet access is limited and business ownership is only 2.2% of the state's total. This could be attributed to a combination of factors including previous population undercounts and unequal distribution of funding. It is hoped by taking a closer look at these indicators, it will show the inequality and encourage further research to ultimately eliminate differences in economic opportunities.

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LATIN AMERICAN BASEBALL PLAYERS IN THE U.S. MINOR LEAGUE SYSTEM

TAYLOR RIELLY, International Studies, Senior
CLARKE SPEED, *American Indian Studies*

The role played by baseball within the United States and Latin America continues to evolve. This research looks at the experiences of Latino ballplayers within the U.S. minor league system and explores the variant paths taken by Latino players in response to the cultural obstacles faced in the transition to U.S. minor league contexts. What strategies do players adopt when confronted with linguistic barriers? How do players cope with foreign environments? How are the different strategies adopted by individual players related to their backgrounds and goals, and the multiple contexts within which they operate? In order to address these questions, I spent the summer of 2001 with the Yakima Bears minor league baseball team and collected data through interviews and observations. The team had from seven to nine Latino players on its roster throughout the season, about half of whom hailed from the Dominican Republic. The information I collected from the research suggests that different players employ different strategies in similar situations; my initial explanations for this variance rest on the unique methods of resistance or coping available to players based on their different backgrounds and goals. The players' experiences are situated in larger bodies of literature that address the lives of trans-national migrants and the processes of identity and community construction. This allows for a look at the nature of the transnational community established by the Bears' Latino ballplayers and how different players used that community. In general, this research suggests alternate perspectives on transnational migration and identity construction through its examination of individuals whose perspectives differ from other transnational workers.

NEWS MEDIA AND AMERICAN NATIONAL IDENTITY: SEPTEMBER 11 AND THE AFTERMATH

JAMAL SIDDIQUI, Communications, Senior
MARI LONDON, Communications, Senior
MARGARET STEVENS, Communications, Senior
DAVID DOMKE, *Communications*

September 11, 2001, redefined America's social, political, and economic landscape, arguably prompting a crisis in American psyche and identity. Our research addresses the nature of the relationship between U.S. national identity and news media in the period surrounding Sept. 11. The goal of the research is to explore the relationship between media and national identity *over time* to examine potential trends. To fulfill this objective, we content-analyzed news texts and photographic images in Time magazine. A strict coding-criteria was established to capture meaningful facets of national identity language and communication patterns present in public discourse. These include, but are not limited to the following textual representations: (a) attribution of blame *away* from the United States; (b) repetitive emphasis upon and praise of core American values; (c) allusions to historical American icons; and (d) emphasis upon unity among the U.S. public and many leading nation-states. In photographic images we have coded for the presence of 19 elements, including the American flag, images of the President and citizen mourners, and treatment of the suspected terrorists. Our research was conducted as follows: we analyzed photographic representations over a six month period – three months prior to and three months after September 11. Analysis of the news stories focused only on the three months post-Sept. 11. The coding of the images is a straightforward analysis of elements present in the images. The textual coding assesses all articles and editorials based on source, topics discussed, and language relevant to national identity. As of this writing, we are close to completion of these content analyses. Interpretation and analysis based on the findings will be completed over the course of the next 4-6 weeks. We look forward to the opportunity to share our findings with the broader academic community here at the University.

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WASTE HABITS : AN AUDIO DOCUMENTARY

ELISABETH HOWE, Community and Environmental Planning, Senior
CHRISTOPHER CAMPBELL, *Community and Environmental Planning*

Collection, transport and final destination of solid waste is one of the most pressing challenges in today's urban environment. What behaviors contribute most to this problem? This research will follow the trail of contemporary waste from desired product to unwanted burden. I hope to create an engaging link between the subjects of my research and my audience through the use of recorded audio. My approach will include a list of interview subjects targeted as witnesses to the process of waste production. Their testimonials will be interspersed with relevant literary excerpts and my reflections and experiences as I explore this ordinary, yet fascinating topic. My findings to date have alluded to a process best explored in a sociological context. This has guided my research to a testimonial, or storytelling, format. With these stories I expect to follow the inadvertent journey from consumption and convenience to massive waste production.

PARENT CHILD MONITORING AMONG IMMIGRANT VIETNAMESE AND CAMBODIAN FAMILIES

CAM-TU VO, Social Welfare, Senior, PRESIDENTIAL SCHOLAR
TRACY HARACHI, *Social Work*

The myth of Asians as the "model minority" continues to be perpetuated by the media. Yet, locally in the Seattle, Washington area, this myth has been dispelled by increasing levels of problem behaviors among Asian/Pacific Islander youth as reported both by the City of Seattle Police Department and the Seattle School District. There is a significant body of literature from the U.S. and other industrial countries that provides strong evidence for the association of poor family functioning with the development of problem behaviors such as delinquency, oppositional behavior, and poor school performance. Family management, in particular, poor monitoring, has shown to have direct effects on child outcomes. Few studies exist which have examined parent-child monitoring among Asian/Pacific Islander populations, in particular among immigrants. The Cross-Cultural Families Study began in 1998 to collect data from two Southeast Asian populations, Vietnamese and Cambodian, as well as an Anglo, English-speaking sample. The intent of the pilot was to examine the cross-cultural equivalency of various family management measures between these three populations. An extensive translation, back translation, and pre-testing effort occurred prior to data collection. A random sample of Vietnamese, Cambodian and Anglo families with 2nd through 4th grades students in the Seattle area were approached and invited to participate in the study. Interview data were collected from 452 mothers, which reflected 89% of the randomly selected sample. Interviews ranged in length from one to two and half hours. This oral presentation examines the construct of monitoring as reported by Cambodian and Vietnamese mothers who have immigrated to the U.S. The presentation presents descriptive statistics on the frequency of various monitoring behaviors as well as correlations between monitoring, length of time in U.S., acculturation, and parent report of early antisocial behavior.

ENVIRONMENTAL POLICY, PERSPECTIVE, AND CHANGE

Session Moderator: Craig ZumBrunnen, Geography

Student Moderator: Allison Van, Biology, Community and Environment Planning, and Environmental Studies, Senior

AGRO-ECONOMIC SUSTAINABILITY IN YANYUAN, CHINA?

JOANNE HO, International Studies, Senior, MARY GATES SCHOLAR

STEVAN HARRELL, *Anthropology*

GRETCHEN KALONJI, *Materials Science and Engineering*

In the mountain hills of the Sichuan province in China is a village whose apple industry has collapsed due to global overproductions. The question is, can this village sustain an export-oriented agro-industry? If so, what are the methods of approach towards sustainability? This project examines the factors of production and consumption that contribute to the rise and fall of Yanyuan's apple industry. Areas of concern includes 1) ecological variables and cultivation practices, 2) methods of apple processing, 3) means of transport, and 4) market forces of supply and demand in nearby regions. Theoretical solutions under these four categories have been found to achieve sustainability, and further research in the field in 2003 will test these probable solutions. This project contributes to the economic welfare of the community of Yanyuan, providing plausible solutions for the local apple industry to overcome negative impacts caused by the effects of the global apple crisis.

CAN (AND SHOULD) A BUREAUCRACY ENGAGE THE PUBLIC? A FRAMEWORK FOR ASSESSING COMMUNITY INVOLVEMENT INITIATIVES WITHIN THE U.S. ENVIRONMENTAL PROTECTION AGENCY

ALLISON VAN, Biology, Community and Environment Planning, and Environmental Studies, Senior,

MARY GATES SCHOLAR, TRUMAN SCHOLAR

CLARE RYAN, *Forest Resources*

The U.S. Environmental Protection Agency was appropriated 7.3 billion dollars to carry out its operations in 2002. The vast majority of that money was used to support regulatory processes. A small portion was spent on programs that engage communities in solving local environmental problems. Experts argue about the relative effectiveness of regulation and community-based programs in protecting the environment. These arguments are almost exclusively devoid of strong evidence on either side. This lack of clear information means that either community-based programs are potentially important and woefully under-funded, or that they are wasteful and taking resources away from regulatory programs. This study develops a framework for categorizing and assessing community-based programs and considers the potential of such programs for transforming federal environmental protection.

ENVIRONMENTAL POLICY, PERSPECTIVE, AND CHANGE

PUBLIC PLACE EVENT RECYCLING PROGRAM DEVELOPMENT

PAT KAUFMAN, Community and Environmental Planning, Senior
ROSALIND SCHUESSLER, Urban Design and Planning
CHRISTOPHER CAMPBELL, Community and Environmental Planning

The City of Seattle is world famous for their leadership in innovative recycling programs. During winter quarter of my junior year in Community and Environmental Planning I wrote a 15 page term paper which focused on an environmental response. My paper led me to developing an internship with Seattle Public Utilities (SPU) to create yet another innovative recycling program for the City of Seattle. My plan addresses the need to collect and recycle cans and bottles at community festivals. The Community Services Division at SPU has given me support through one on one supervision, team oriented plan review and an overall collaborative approach to developing the Public Place Event Recycling program. PPER will build on elements from an established, successful event recycling program at Seattle Center. Every detail of the program, from bin design and signage to transportation logistics and efficient volunteer training procedures are being focused on. In just eight short weeks we hope to have the program up and running in time for use at the University Street Fair.

THE ENVIRONMENTAL HISTORY OF THE MOUNTAINS TO SOUND GREENWAY: CHANGING VALUES FOR THE LAND OVER TIME

KRISTEN PAYNTER, Environmental Studies and Biology, Senior
LINDA NASH, History

Using the Mountains to Sound Greenway as a focus, I am researching the changing values that humans have placed on a specific landscape over time, how this has affected the history of what is now known as the "Greenway," and how the Mountains to Sound Greenway Trust reflects the consolidation of preservation values even as it works amidst a set of differing values for the land. Through library research and on-site research working with the Mountains to Sound Greenway Trust, I have observed historical values for the land which include: resource values (such as mining and logging) in conjunction with the Westward migration, farming in conjunction with settlement, recreational values, aesthetic values in conjunction with romantic nostalgia and ecosystem values in conjunction with the creation of ecology as a science. All of these values have helped shape the history of the Greenway and its preservation within the last two decades. The Mountains to Sound Greenway Trust is a local example of how an organization can pursue a preservation agenda amidst an arena of multiple, often competing values for land-use.

IN CONSIDERATION OF THE SUSTENANCE OF SALMON

LINDA LYSHALL, Environmental Studies, Senior
DAVE FLUHARTY, Marine Affairs

The Growth Management Act's new mandate to implement Best Available Science into Critical Area Ordinances will go into effect September 2002. This will require an update and revision of many county codes and permitting requirements, and will most likely gain some ground for the ecological integrity of near-shore habitat. With growing concern about the local salmon populations, scientists and policy makers are looking at important aspects of their sustainability. One aspect is the food on which they survive. Forage fish are a crucial link in the food chain of the ocean. This presentation is focused primarily on forage fish spawning habitat and policy changes in the San Juan Islands and other Northwest Straits counties. It provides both a big picture and a detailed view of many of the concerns and challenges for policy makers and implementers at both the state and the county level.

EXPLORATIONS AND DISCOVERIES

Session Moderator: Paul Boynton, Physics and Astronomy
Student Moderator: Jeffrey Giansiracusa, Mathematics and Physics, Junior

BUBBLE PLUMES IN THE SURF-ZONE

JEFFREY HARRIS, Mathematics and Oceanography, Senior
FREDERICK STAHR, Oceanography
WILLIAM WILCOCK, Oceanography

In the surf-zone, where waves break, air bubbles become entrained in the water. When this happens sporadically, these events can be considered individual bubble plumes. These bubble plumes are key contributors to adding oxygen to the ocean, mixing surface waters, and attenuating sound. Because the plumes are very hard to describe mathematically, experiments need to be run in order to determine what affects the plume characteristics in time and space. This research was done as a part of an oceanography laboratory class. Potential variables of interest include plume height, and plume duration, as compared to the initial velocity and angle of the plume, as well as the initial 'concentration'. Very advanced equipment is required to observe bubbles from breaking waves in any quantitative sense, so the experimental setup required the use of glass beads to simulate bubbles. Because glass is denser than water, the problem is inverted (i.e. glass beads are injected into a tank from below, to observe them settling down, as opposed to bubbles crashing from above and rising to the surface). To date, a reliable system of creating the plumes has been constructed, that is both repeatable and allows for easy manipulation of the initial conditions, and data collection with a video camera has begun.

DAWGSTAR NANOSATELLITE

DANIEL BROWN, Aerospace Engineering, Junior, MARY GATES SCHOLAR
MARK CAMPBELL, Mechanical and Aerospace Engineering

Each day, our global society becomes more dependent on satellite technology for communication, scientific development, and military applications. Many large satellites cost from \$1,000 to \$10,000 per pound to put into orbit. Nanosatellites, weighing less than 10 kg, are cheaper to produce, easier to put into orbit, and can fly in formation with other satellites. They can be built and flown in a formation such that they perform the same functions as a larger, more expensive satellite, or in some cases, unique functions that can only be performed by the distribution. A distinct advantage of nanosatellites is the broad area that can be covered with a multi-satellite formation. The technology to miniaturize and fly these small formations of satellites is in the beginning stages of development. The University of Washington "Dawgstar" Nanosatellite is part of a three-nanosatellite stack sponsored by the Department of Defense, NASA, and industry. Utah State University and Virginia Polytechnic are engineering the other two nanosatellites in the stack. They will fly as a cluster with the UW satellite to demonstrate miniaturized satellite technology, formation flying, and take atmospheric measurements. The hexagonal, box shaped spacecrafts will be deployed from a shuttle connected in a stack. Once in orbit, each satellite will separate from the stack and begin individual operations. For the following weeks, the satellites will fly in various formations as they communicate with each other and uplink instructions from ground control. Micro-pulsed plasma thrusters, an innovative technology designed at UW, gives Dawgstar complete maneuverability in attitude and formation flying. The Dawgstar will conduct a number of science experiments, including electron density and electron flux measurements of the atmosphere to improve the current collection of known atmospheric data. Dawgstar is currently in the final stages of testing and integration.

EXPLORATIONS AND DISCOVERIES

DEATH, DESTRUCTION, AND STABLE ISOTOPES: THE STABLE ISOTOPE RECORD ACROSS THE EARTH'S FIVE MAJOR MASS EXTINCTION BOUNDARIES

THOMAS EVANS, Geology, Senior, MARY GATES SCHOLAR
PETER WARD, *Earth and Space Sciences*

Understanding what happened to the global biota during the earth's five major mass extinctions is critically important in understanding biological resilience and the evolutionary history of modern species. Valuable information includes the cause of the extinction event, its total duration, and how long the earth's biota took to recover. The causes of each extinction are controversial, however, the duration and recovery times of the planet's biology can be roughly approximated by the biomass present on the earth at any point in time. $\delta^{13}\text{C}$ measurements (the ratio between C_{13} and C_{12} compared to a standard) are directly related to the amount of plant biomass on the planet's surface at the time of growth and consequent deposition and can be used as a proxy for global biomass or productivity. Presented here will be the past evidence of global productivity change at four of the earth's five mass extinctions and the recent work we have completed on the global productivity changes across the Jurassic/Triassic boundary, the remaining fifth extinction. Preliminary results related to the Permian/Triassic extinction, and the future direction of our research on this boundary will also be presented. Our research has focused primarily on $\delta^{13}\text{C}$ measurements on marine deposits subaerially exposed on the Queen Charlotte Islands off the northwestern coast of Canada. We collected isotope samples to create a stable carbon isotope stratigraphy across the Jurassic/Triassic boundary as well as collected fossils for biostratigraphic control. We recently started our Permian/Triassic boundary work with a trip to South Africa where we collected isotope samples and vertebrate fossils, again for biostratigraphic control. From these data, we can gain valuable insights into the earth's response to catastrophic biological collapse.

HIGH SCHOOL STUDENTS AND HIGH-ENERGY ASTROPHYSICS

PAUL EDMON, Physics, Sophomore
MARA LEMAGIE, Physics, Sophomore
PAUL SMITH, Physics, Senior
JEFFERY WILKES, *Physics*

Cosmic rays are high-energy charged particles that come from outer space. The Washington Area Large-scale Time coincidence Array (WALTA) intends to collect data on the highest energy cosmic rays, because current data is not sufficient for an accurate assessment of where these particles are coming from and how they interact with other known phenomenon. Knowing where these particles are coming from and how they interact will help direct the scientific community in further studies of these poorly understood phenomena. To gather data on these high-energy particles, particle shower detectors are being placed in Seattle Area high schools in order to look for particle showers associated with a high-energy particle hitting the upper atmosphere. Currently the project is refurbishing equipment rescued from a past experiment with the help of the teachers and students from the participating high schools. Also, research with the help of the teachers and high school students, is underway for a method to most effectively set up these detectors in schools and maximizing the efficiency of the detector itself.

EXPLORATIONS AND DISCOVERIES

SUPERMACHO: A NEXT GENERATION GRAVITATIONAL MICROLENSING SURVEY

BRYAN HENDERSON, Astronomy, Physics, and Philosophy, Senior, MARY GATES SCHOLAR, SPACE GRANT SCHOLAR
CHRIS STUBBS, Physics and Astronomy

One of the most fundamental problems in all of astrophysics is the fact that “dark matter,” which dominates the gravitational behavior of all known galaxies, is far from understood in terms of both its nature and distribution throughout the universe. This is further complicated by the fact that in order to investigate the problem, scientists are faced with the conundrum of trying to “see” something that is, by definition, “dark.” Nonetheless, UW Professor Chris Stubbs and his colleagues observed a sudden transient brightening of stars that is attributed to gravitational microlensing—an event where, from Earth’s vantage point, a large foreground concentration of mass effectively focuses light from background stars onto a smaller solid angle of sky (hence the increased brightness). The mass that triggered the events was quite possibly dark matter and hence the project, dubbed “**MACHO**” (standing for **M**assive **C**ompact **H**alo **O**bjects—a theoretical form of dark matter), may have successfully detected the indirect effects of one of nature’s greatest mysteries. Now, an enhanced version of this project aims to discriminate between lensing objects in the Galactic disk, Galactic halo, and near the background source stars. The program, appropriately titled “**SuperMACHO**,” kicked off this past November with the first of what will be five winters of observing in Chile. Its effective attempt to pinpoint the location of the lensing population will allow us to better gauge whether or not the transient brightening of background starlight is in fact due to dark matter. I am working with Dr. Stubbs and his graduate students on the large task of both calibrating the many nights worth of data and assembling these reduced images into an appropriate catalogue. We will in turn search this catalogue for objects whose brightness changes over time—an essential feature of a lensing event. By doing so, Dr. Stubbs and our group can return to Chile next winter with a more confined list of targets to observe—targets which may ultimately provide the best tracers of dark matter yet.

FOREIGN POLICY AND DIPLOMACY

Session Moderator: Joel Migdal, International Studies
Student Moderator: Meghan Pinch, International Studies and Jewish Studies, Senior

AMERICAN GROUP

JOSHUA JACOBS, International Studies, Senior
KARI LAURVICK, International Studies, Senior
MICHAEL SCHADLER, International Studies, Senior
XHENI SHEHU, International Studies, Senior
JOEL MIGDAL, *International Studies*

This research was done in conjunction with a Task Force project for the Jackson School of International Studies. The goal was to create a policy proposal to the Bush Administration on the Israeli-Palestinian conflict. We will present with three other groups, each tackling separate aspects of the issue. The "American foreign policy" group will attempt to answer what level of American involvement in the Israeli-Palestinian conflict is appropriate for future policy prescriptions. We will attempt to answer this question by addressing the following issues: reasons for American participation in the Israeli-Palestinian conflict since 1991, the effects of domestic political consideration on the formulation on policy towards the region, the role of oil on American policy towards the conflict, the strains of the War on Terrorism on America's role as a mediator, the role of Egypt and Saudi Arabia in the peace process.

INTERACTING WITH ISRAEL: CONSIDERING ISRAEL'S POSITION IN THE MIDDLE EAST CONFLICT

JONATHAN JUDY, International Studies, Senior
KATRIN ANDREWS, International Studies and German Language & Literature, Senior
CARA FITZPATRICK, International Studies and Communications, Senior
JOEL MIGDAL, *International Studies*

This research was done in conjunction with a Task Force project for the Jackson School of International Studies. The goal was to create a policy recommendation for the Bush Administration on the Israeli-Palestinian conflict. We will present with three other groups, each tackling separate aspects of the conflict. "Interacting with Israel" was researched and written by Katrin Andrews, Cara Fitzpatrick, and Jonathan Judy. This research considers Israeli interests the US must understand in order to provide simultaneous assurance and pressure in persuading Israel to commit to a peace process with the Palestinians. The three areas of focus in this paper are the Israeli government, public opinion, and the issue of Israeli settlement policy. These three subjects converge upon the realization that the US must know how to deal with a government that has been unstable, a public opinion that responds overwhelmingly to issues of violence and economics, and a settlement issue that has been a core Israeli interest since 1967. In order to foster Israel's commitment to a peace process, the United States must hold Israeli interests as a backdrop for future proceedings. With this in mind, we have found that it is feasible to put more pressure on Israel to commit to a regional peace process. However, this must be done within the context of assuring Israel of its relationship with the US. This assurance comes with greater understanding of Israeli interests. Furthermore, the implications of this research indicate that failed attempts at removing the obstacles to peace in the Middle East have come due to a lack of third party commitment. Thus, the US must support its rhetoric with action and provide plausible solutions that satisfy Israel's primary concerns.

FOREIGN POLICY AND DIPLOMACY

ISRAEL-PALESTINIAN NEGOTIATIONS

KAILANI CHIN-HIDANO, International Studies, Senior

RYAN PHILLIPS, International Studies, Senior

DANA SHEMORRY, International Studies, Senior

CASEY BOWMAN, International Studies, Senior

JOEL MIGDAL, *International Studies*

This research was done in conjunction with a Task Force project for the Jackson School of International Studies. The goal was to create a policy proposal to the Bush Administration on the Israeli-Palestinian conflict. We will present with three other groups, each tackling a separate aspect of the issue. The Israeli-Palestinian Negotiations Group will address the negotiation aspect of the Israeli-Palestinian conflict. There have been four key negotiations since 1991: the Madrid Conference, the Oslo Accords, the Wye Accords and the 2000 Camp David Summit. Although these negotiations have contributed to the advancement of the peace process, they have not resolved the fundamental issues of the conflict. Why haven't these negotiations resolved the fundamental issues of the Israeli-Palestinian conflict and what does the Bush Administration need to do in order to carry out successful negotiations? The answer to this question lies in the analysis of the successes and failures of each of the four negotiations. The group will make policy recommendations for the Bush Administration based on lessons learned from past successes and failures in negotiations. The successes and failures will be broken down into three categories: 1) Timing 2) Actors and 3) The Formal Negotiation Process. These categories create the framework in which to view the successes and failures and point to what action the Bush Administration should take in the future.

FOREIGN POLICY AND DIPLOMACY

THE PALESTINIAN-ISRAELI CONFLICT: A PALESTINIAN PERSPECTIVE

DANIELLE HAYASHI, International Studies, Senior, MARY GATES SCHOLAR, MCNAIR SCHOLAR
JOEL MIGDAL, *International Studies*

The Palestinians and the Israelis have been trying to achieve peace amidst violence since 1967 when Israel captured control of the Sinai Peninsula, the West Bank and the Golan Heights. These failed attempts at peace, the ongoing violence, and the oppressive conditions of Israeli occupation caused a loss in hope among Palestinians, which led to the 1987 intifada—the uprising of the Palestinians against Israel's Occupation. This was a rational political, and largely grassroots, response by the Palestinians to political, cultural and ideological suppression, economic exploitation, institutional destructuring, and expansion of Israeli settlements. The intense violence finally ended with the signing of the Oslo Accords in 1993 but broke out again in 2000 after the failure of negotiations between the Israelis and the Palestinians at Camp David. The increased involvement of militant Islamists and the intensification of Israeli military crackdowns has resulted in substantially more deaths and an erosion of the peace process. Because the issue of settlements is so contentious and Palestinians are at a clear disadvantage to Israel politically, militarily and economically, bringing them back to negotiations will require some action by Israel toward stopping settlement construction. Yasser Arafat, President of the Palestinian Authority, has demonstrated corruption through mismanagement of public funds, high rates of investment in military at the expense of social institutions, and the resulting human rights violations by Palestinian forces. However, the Palestinian Authority is the only legitimate institution available to represent Palestinian interests, the alternative being the Islamist group Hamas, which is officially considered a terrorist group by the US but has gained legitimacy among Palestinians for its social welfare services. The US should boost the PA's legitimacy by helping it install institutions which serve the needs of its constituents, thus reducing the influence of Islamist groups which oppose the peace process.

THE SOURCES OF PUBLIC SUPPORT FOR FOREIGN INTERVENTION

MEGHANN ROTHER, Political Science and International Studies, Senior
BRYAN JONES, *Political Science*

What causes public support for foreign intervention? Under what conditions will the American public support troops abroad? Support for the Gulf War was low initially, but the tide turned soon after troops were sent to the Middle East. In 1993 the United States sent troops to Somalia on a humanitarian mission, but withdrew as the result of the deaths of eighteen servicemen, the first humanitarian casualties ever in the United States' history: this caused great discontent with the American public. If support is condition to depiction by political leaders or the media, cases will never be portrayed as humanitarian again. If so, this may explain why troop deployment to Bosnia/Kosovo was labeled as matter of national interest rather than humanitarian. But how does the public differentiate between humanitarian and national interest issues? and why are casualties abroad acceptable in cases of national interest, but not humanitarian missions? To explain this puzzle I plan to look at the New York Times dataset and Congressional Hearings data from the Policy Agendas Project at the University of Washington to assess the amount of attention paid to international issues prior to the United States' involvement and then compare this to the degree of the United States' involvement in these issues. I will also look at public opinion polls (Gallup, etc.) to see how the public responded to each case study. Using the cases of Somalia, the Gulf War and Bosnia/Kosovo comparatively, I will define the variables that affect favorable or unfavorable public response towards foreign intervention. By addressing the media's attention followed by the United States' involvement and the public's reaction to each issue I expect to find that the media does indeed have an affect on public opinion and by determining whether a case has been publicized as 'humanitarian' or as 'a matter of national interest' I expect to find that the public responds more favorably and with increased flexibility regarding casualties and spending on matters of national interest. Because of this, we can expect to see the United States intervene in issues termed only as 'national interest' in the future.

GENETIC PERSPECTIVES

Session Moderator: Robin Wright, Zoology

Student Moderator: Steven Hardy, Comparative History of Ideas and Neurobiology, Senior

A "PURE" DOMINANT SPINOCEREBELLAR ATAXIA MAPS TO CHROMOSOME 19Q13.4-QTER

LAURA BYLENOK, Biology, Senior, MARY GATES SCHOLAR, SPACE GRANT SCHOLAR
WENDY RASKIND, *Medical Genetics*

The autosomal dominant (AD) spinocerebellar ataxias (SCAs) are a clinically and genetically heterogeneous group of neurodegenerative disorders. They are characterized by slowly progressive lower limb spasticity and ataxia, often accompanied by poor coordination of finger, hand, or eye movements, and occasionally accompanied by dementia. Some types of SCAs are also associated with neuropathy, pyramidal signs, extrapyramidal signs, ophthalmoparesis, or retinopathy; these are often referred to as "complex" SCAs. Although molecular genetic studies have so far implicated 16 loci in the etiology of the disease, approximately 30% of SCA families remain unlinked. We identified a four generation American family with a "pure" cerebellar ataxia displaying an AD pattern of inheritance. The disease typically begins in the third and fourth decades and there is no evidence for anticipation. The disease is slowly progressive and does not appear to decrease life expectancy. Clinical DNA testing excluded SCA1, 2, 3, 6, 7 and 8. A whole genome scan at a 10-cM level found suggestive evidence for linkage to chromosome 19, with a LOD score of 2.49 for D19S571. Multipoint analyses and haplotype reconstruction indicated that other, weaker, signals were false positives. More detailed mapping in the chromosome 19 region provided a maximum two point LOD score of 2.57 at $\alpha = 0.00$ for D19S254 and a maximum multipoint LOD score of 4.72 for marker D19S571. By haplotype construction a 22 cM critical region from D19S601 to the q telomere was defined. All the affected individuals and two unaffected individuals in the youngest generation carry the disease associated haplotype. The critical region overlaps with the locus for SCA14, a disease described in a single Japanese family and characterized by axial myoclonus. Myoclonus was not seen in the family we studied, but it remains possible that the two disorders are allelic variants.

GENETIC PERSPECTIVES

GENOMIC INSTABILITY IN THE AGING COLON

MELISSA PEARLMAN, Cellular and Molecular Biology, Senior, HOWARD HUGHES SCHOLAR

PETER RABINOVITCH, Pathology

JACINTHA O'SULLIVAN, Pathology

Telomere shortening is known to occur in an environment of oxidative stress and cellular proliferation. Shortening of telomeres occurs during cell division (in the absence of telomerase activity) and is a hallmark of cellular aging. It has been hypothesized that telomere shortening may promote chromosomal instability and play a role in the aging process. We are interested in examining the relationship between telomere length and chromosomal instability in the aging colon. Age alone is a known risk factor for development of colorectal polyps and cancer. In collaboration with Dr. John Potter at the Fred Hutchinson Cancer Research Center, our laboratory has collected a large number of normal colon biopsies from patients of different ages, ranging from 33 to 79 years old. To determine whether telomere shortening is a contributing factor in aging, telomere measurements were performed using a novel telomere length measurement assay developed in our lab. In this assay, a fluorescent-labeled peptide nucleic acid (PNA) probe binds to telomeric DNA sequences, obtaining fluorescence intensity proportional to telomere length. Digital images are acquired using confocal microscopy and evaluated using image analysis software (Optimas 6.0, Media Cybernetics). Analysis of colon interphase cells in this manner allows us to test the hypothesis that telomeres of populations of colonic epithelial cells are shorter than those of adjacent stromal cells, which serve as internal controls. Preliminary data indicate increased heterogeneity of telomere lengths in old patients (73-79 years old) compared to young patients (33-47 years old), however, no change in mean telomere length was observed. We will use Fluorescence In Situ Hybridization (FISH) to assess chromosomal instability in old patients with long telomeres versus old patients with short telomeres in order to determine whether shortening of telomeres is related to chromosomal instability and cancer risk in the aging colon.

THE ROLE OF THE WERNER SYNDROME PROTEIN IN GLIOMA ALKYLATOR RESISTANCE

ELIZABETH MEADE, Cellular and Molecular Biology, Senior

JOHN SILBER, Neurological Surgery

DNA alkylating agents such as temozolomide (TMZ) and 1,3-bis(2-chloroethyl)-1-nitrosourea (BCNU) are commonly used in the treatment of malignant brain tumors because of their cytotoxic effects. O⁶-methylguanine (which is the result of treatment with TMZ) and the interstrand cross-link derivative of O⁶-chloroethylguanine (a result of treatment with BCNU) are documented cytotoxic lesions. However, brain tumors become resistant to these treatments within a matter of weeks or months. The Werner syndrome protein (WRN) is a DNA helicase that also contains exonuclease activity. Our hypothesis is that WRN contributes to resistance to treatments such as TMZ and BCNU by functioning in DNA repair. O⁶-methylguanine-DNA methyltransferase (MGMT) is the principal mechanism for removing cytotoxic O⁶-alkylguanine adducts from DNA. To determine the contribution of WRN to resistance to O⁶-alkylguanine adducts, we examined the effects of antisense (ASO)-mediated suppression of WRN in the MGMT-expressing glioma cell line SF767. Suppression of WRN did not produce increased sensitivity to TMZ or BCNU in this line. However, when SF767 was treated with O⁶-benzylguanine, a specific inhibitor of MGMT, suppression of WRN was accompanied by increased sensitivity to both TMZ and BCNU. Importantly, the cell line SNB19 lacks MGMT. Suppression of WRN by antisense oligonucleotides in SNB19 also conferred increased sensitivity to TMZ and BCNU. Since unrepaired O⁶-methylguanine and interstrand crosslinks are strong blocks to DNA repair, the data therefore indicate that WRN is required for the recovery of human glioma cells from blocked DNA replication. Consequently, WRN contributes to brain tumor resistance to alkylating agents by repairing cytotoxic lesions.

GENETIC PERSPECTIVES

MITOCHONDRIAL MUTATIONS IN OVARIAN CANCERS MAY BE USED TO DETECT FREE TUMOR DNA IN PLASMA

SARITA MAHTANI, Cellular and Molecular Biology, Senior, MARY GATES SCHOLAR, HOWARD HUGHES SCHOLAR
ELIZABETH SWISHER, Obstetrics and Gynecology
MARY-CLAIRE KING, Medical Genetics

The mitochondrial genome is present in high copy numbers and is more prone to mutation than nuclear DNA. Mitochondrial mutations could therefore be more readily detectable than nuclear DNA changes as a tumor-specific molecular marker. We sought to determine the frequency of mutations in the non-coding D-loop of the mitochondrial genome in ovarian cancers and assess whether such tumor-specific mitochondrial variants could be used to identify circulating tumor DNA in matched plasma samples. The hypervariable region 1 and hypervariable region 2 of the non-coding mitochondrial D-loop were amplified in two PCR reactions from matched normal, tumor, and plasma DNA from 19 women with ovarian cancer. PCR products were purified and sequenced. Sequences were analyzed with phredPhrap software and compared to the published Cambridge mitochondrial sequence. All sequence variants were confirmed in a second separate sequencing reaction. Variants were compared with the database of known mitochondrial polymorphisms on MITOMAP: A Human Mitochondrial Genome Database at <http://www.gen.emory.edu/mitomap.html>. Four tumors (21%) were found to have identifiable sequence differences in comparison to matched normal DNA from lymphocytes. A total of eight variants were identified in these four cancers. All variants were consistent with previously identified variants listed on MITOMAP. The plasma from two of four cases with tumor-specific mitochondrial variants demonstrated the tumor sequence. The other two cases contained only the normal sequence. In normal volunteer controls, plasma DNA always matched the sequence of normal DNA, even in cases of heteroplasmic sequence. This is the first study to demonstrate that tumor-specific mitochondrial sequence variants may be used to identify circulating tumor DNA in the plasma of patients with cancer. We are evaluating alternative techniques to DNA sequencing to increase the sensitivity of using mitochondrial variants to detect free tumor DNA. The detection of free tumor DNA in plasma or peritoneal fluid ultimately could have applicability as a diagnostic test for ovarian cancer.

GENETIC PERSPECTIVES

MUTATIONS IN HUMAN DNA POLYMERASE η MOTIF II ALTER BYPASS OF DNA LESIONS

KELLIE VIGNA, Biochemistry, Cellular and Molecular Biology, Senior, MARY GATES SCHOLAR
LAWRENCE LOEB, Pathology
EITAN GLICK, Pathology

Countless cellular pathways can lead to the development of cancer. Ever since the discovery that cancer cells contain multiple mutations, it has been of great interest to examine how these mutations accumulate. Our research focuses on the accuracy during DNA replication with respect to a specific protein, human DNA polymerase η (hPol η). This DNA polymerase is encoded by the Xeroderma pigmentosum variant (XPV) gene, and mutations in this gene are associated with Xeroderma pigmentosum syndrome, a disease characterized by hypersensitivity to sunlight and high incidence of skin cancer. hPol η belongs to the Y-family of DNA polymerases, which specialize in synthesizing past template lesions that block the progression of other DNA polymerases functioning within the cell. Contributing to normal resistance to sunlight-induced skin cancer, hPol η accurately synthesizes past UV-associated cis-syn cyclobutane thymine dimers. In contrast to its accuracy in bypassing thymine dimers, hPol η has a strikingly low fidelity when replicating undamaged DNA. In order to better characterize this polymerase in terms of its structure-function relationship, we performed a mutational analysis of motif II, a highly conserved sequence across the Y-family DNA polymerases. Recently, motif II was reported to reside in the fingers domain, forming part of the active site. We used a yeast-based complementation system to isolate biologically active mutants created by random sequence mutagenesis, synthesized the mutant proteins *in vitro*, and assessed their ability to bypass thymine dimers. We were able to identify two critical residues for catalytic activity, and found one mutant polymerase, S62G, that exhibited enhanced activity with the ability to bypass five other site-specific lesions. This finding could eventually offer potential for protection of cells against chemotherapeutic agents used in cancer therapy. More immediately, our system of study may serve as a prototype for studying other members of the Y-family DNA polymerases.

THE BRCA1/BARD1 COMPLEX, A UBIQUITIN LIGASE, AND ITS POTENTIAL ROLE IN HEREDITARY BREAST CANCER

CHIMERA PEET, Biochemistry and Microbiology, Senior, HOWARD HUGHES SCHOLAR
RACHEL KLEVITZ, Biochemistry

BRCA1 is one of two major tumor suppressor genes implicated in hereditary breast and ovarian cancers. Since BRCA1 (Breast Cancer type 1 susceptibility protein) was discovered in 1994, it has been shown that germline mutations in this gene greatly increases one's risk in developing breast and ovarian cancer. A critical question in breast cancer research is how are mutations in BRCA1 involved in causing cancer? BRCA1 appears to be involved in DNA damage repair pathways as well as the ubiquitin/proteasome process. It has been recently shown that the complex formed between the N-terminus of BRCA1 and BARD1 (BRCA1 Associated Ring Domain protein-1) has ubiquitin ligase activity. Ubiquitin ligases are proteins that specifically tag other proteins to be degraded by the proteasome. This process gives the cell a way of regulating the levels of specific proteins via degradation. A pivotal question regarding the BRCA1/BARD1 ubiquitin ligase is what are its targets in the cell? My project is to design, generate, and characterize a novel BRCA1/BARD1 fusion protein that will be used to search for putative targets. So far I have designed and sub-cloned my BRCA1/BARD1 fusion protein. I am currently purifying the fusion protein in order to evaluate whether it adopts the same structure as the wild-type BRCA1/BARD1 and whether it has ubiquitin ligase activity. My long-term goal is to utilize my novel fusion protein to discover proteins that interact directly with the BRCA1/BARD1 complex using a Yeast-2 Hybrid screen. This is of particular interest because proteins that interact with this complex are potential targets for degradation by BRCA1. Discovering the proteins that are regulated by the BRCA1/BARD1 complex is an important step to understanding BRCA1's involvement in hereditary breast and ovarian cancer.

INNOVATIVE DESIGNS: STRUCTURES, SYSTEMS, SOLUTIONS

Session Moderator: Alexander Mamishev, Electrical Engineering
Student Moderator: Nels Jewell-Larsen, Electrical Engineering, Junior

CERAMIC FOAMS DERIVED FROM PYROLYSIS OF PRE-CERAMIC POLYMERS

CONAN SIMOES, Ceramic Engineering, Senior
RAJENDRA BORDIA, Material Science and Engineering

Open-cell ceramic foams were processed from pyrolysis of pre-ceramic polymers at 1200° C under argon and nitrogen. A sacrificial polyurethane was primarily used as a blowing agent in this process. The morphology of the foamed polyurethane was retained in the ceramic foam architecture after pyrolysis. The foams produced in this way consisted of amorphous silicon oxycarbide, silicon carbide and silicon nitride ceramics, having a bulk density ranging from 0.2 to 0.9 g/cc and a cell size of less than 500 microns. Compression strengths ranged from 2 to 7 MPa for these materials.

DESIGN AND DEVELOPMENT OF PROTON EXCHANGE MEMBRANE FUEL CELLS

AARON HARRIS, Mechanical Engineering, Senior
JOYCE COOPER, Mechanical Engineering
DANIEL SCHWARTZ, Chemical Engineering

The word fuel cell is tossed around in the media a lot these days. What are fuel cells and how do they work? What is the real market potential for them? What are the issues that are holding back their development? Researchers involved in the Undergraduate Fuel Cell Project have been investigating these questions over the past 5 years. This project involves the design of proton exchange membrane (PEM) fuel cells that run on compressed hydrogen and air, producing only water as their by-product. It is an interdisciplinary effort that combines mechanical, chemical and electrical engineering seniors and juniors. Each quarter teams of students attack a variety of issues ranging from the details of individual cell components to the design of an entire residential fuel cell hybrid system. This past year there have been 4 areas of investigation. The first is the development of membranes. This involves chemical application of catalyst and testing of membranes in small single cell operation. The second area is the development of a cell stack. Students in this group improve upon the cell stack designs of previous quarters. These students also work in manufacturing, assembling and testing of the cell stacks. Development and refining of an automated test stand is the focus of the third group. Their work is the refinement of an automated test stand built last year. This group has focused on designing a humidity sensor that will determine the humidity of gases flowing to and from the cell stack. Lastly an applications group has developed a concept for a hybrid fuel cell system. Working with a customer interested in a self-sustaining weekend cabin on Lopez Island, this group has utilized engineering design procedures to make decisions in the system.

FONT VARIANT RECOGNITION

ERIC WEBSTER, Applied Mathematics, Junior
BRENDAN WALKER, Computer Science and Engineering, Senior
TONY WOO, Industrial Engineering

Though the fonts A (Arial), A (comic sans), and A (Gothic) look similar, their bitmaps (matrix of dots, at several hundred per inch) are quite different. What is it that enables the human eye to recognize invariance, despite the spatial juxtaposition of dots in an image? This talk reports possibly interesting findings, by way of Singular Value Decomposition in matrix operations. Eigen values are extracted from an image array, which provides clues as to what "fundamental frequencies" there are in character recognition; they also suggest how many "terms" are sufficient for approximation or reconstruction. Font invariant recognition of Kanji complements the elegance in the mathematics.

INNOVATIVE DESIGNS: STRUCTURES, SYSTEMS, SOLUTIONS

FIXTURE FOR RADIATION ONCOLOGY

IQBAL BHINDERWALA, Electrical Engineering, Freshman
ERIC WEBSTER, Applied Mathematics, Junior
BRENDAN WALKER, Computer Science and Engineering, Senior
TONY WOO, *Industrial Engineering*

An accuracy of 2mm is desired in the radiation therapy for oncology patients. Depending on the tolerance of the patient, the duration of the treatment, and the frequency of visits vary. For each visit the setting must be repeatable. If keeping a part of the body motionless for 15 minutes is difficult for a healthy adult, maintenance of constant muscle tension for a cancer patient is more difficult. The design and fabrication of a fixture for the accurate and repeatable positioning of the head is presented. This talk traces the conceptualization, detailed design, and actual fabrication of a fixture for patients in Radiation Oncology at the University of Washington.

LOCAL POSITIONING SYSTEM

IQBAL BHINDERWALA, Electrical Engineering, Freshman
BRENDAN WALKER, Computer Science and Engineering, Senior
ERIC WEBSTER, Applied Mathematics, Junior
TONY WOO, *Industrial Engineering*

Locating the source of a signal, such as that from a 911 caller on a cellular phone finds immediate commercial applications, both domestically and globally. While the Global Positioning System (GPS) is commercially available, there are two hidden assumptions, which render the GPS not immediately applicable; they are: (1) line-of-sight distance calculation and (2) synchronization. A GPS system assumes that a line of sight exists between the transmitter and the receiver, but this is not that case in a RF reflective environment like a city. In addition to this, the clock at the source and that at the receiver must be *synchronized* so that the time-of-flight can be converted into distance (by multiplying by the speed of light, for example). Yet, even this is not always possible. But given multiple detectors in the right configuration and by knowing the reflective geometry of the region in question, information on differential locations is obtainable. We offer a minimal solution of three detectors by solving three simultaneous equations in the plane in combination with a forward ray-tracing algorithm. The question then becomes one of obtaining the geometry given the constraints of the transmission media and the reflective materials. Two methods for geometry retrieval will be presented, one for cell phones and another for sniper location. Both the location of a sniper or a cell phone is possible with the appropriate sensors and map information. A demo of these techniques will be used combined with a 3D map of the University of Washington campus that was constructed from an aerial photo and terrain data obtained from the Geography Library in Suzzalo.

PICOSECOND CARRIER DYNAMICS IN ERAS:INGAAS SUPERLATTICES

MARTHA HELENE STAPLETON, Physics, Senior at California Institute of Technology
JURGEN SMET, *Max Planck Institute in Stuttgart Germany, California Institute of Technology*

Semiconductor materials with ultrafast optical response times are increasingly under investigation for their numerous applications in optoelectronic circuitry, including communication technology and experimental studies of quantum mechanical systems. Here we present results characterizing ErAs superlattices, specifically ErAs:InGaAs, as a promising alternative to low temperature grown GaAs. Careful autocorrelation measurements of the photocurrent, using a mode-locked titanium sapphire laser, give picosecond lifetimes of carriers generated and recombined at ErAs island layers.

INNOVATIVE DESIGNS: STRUCTURES, SYSTEMS, SOLUTIONS

ON THE OPTIMIZATION OF LIBS

NOEL FITZGERALD, Chemistry, Senior, MARY GATES SCHOLAR
MICHAEL YOST, *Environmental Health*
RICHARD GAMMON, *Chemistry*

Laser Induced Breakdown Spectroscopy (LIBS) is an analytical technique whereby a focused laser beam promotes plasma formation in a picogram to microgram sized sample, resulting in breakdown of the sample to energized atomic species, and/or molecular fragments. The ensuing atomic emission signals are analyzed by time-resolved spectroscopic techniques. With the availability of miniature and economical lasers and spectrometers, the method is promising for many types of field portable environmental analyses, occupational health studies, and most recently, as screening devices for chemical and biological warfare agents. The LIBS technique has been long plagued by difficulty in resolving the desired analytical signal from additional broadband background radiation, also resulting from plasma formation. Investigators often attempt to optimize various parameters of a LIBS experiment. In this study, it was contemplated that applying the statistical methods of experimental design may provide guidelines for the maximum enhancement of analytical signals. To date, obtaining the first valid analytical signal proved to be an elusive target. Another group of investigators has reported the miniature spectrometer utilized for this study (Ocean Optics, Inc., Dunedin, FL) is not capable of obtaining or resolving the desired signals. This investigation has shown the previously reported results to be in error; the first valid analytical signal has been obtained for an aerosol containing manganese. Successfully obtaining spectra for another dissimilar element would ensure the validity of the experimental apparatus. An element that is dissimilar from manganese, and that would provide useful data for environmental analyses, is carbon. Once spectra are validated for carbon, the experimental design phase of the experiment can be undertaken.

SOL-GEL APPLIED ELECTRODES IN FUEL CELLS

MIKE SHYU, Ceramics Engineering, Senior
SUZANNE MA, Chemical Engineering, Senior
GRETCHEN KALONJI, *Materials Science and Engineering*
RAJENDRA BORDIA, *Materials Science and Engineering*

Within the field of solid oxide fuel cells (SOFC), the cathode is critical to the catalysis of oxygen; however the synthesis of the cathode is still developing. The purpose of this project is to study a method for the synthesis of lanthanum manganite (LaMnO_3) to be used as the cathode. Problems arise however when trying to get this material to adhere to another ceramic through sol-gel processing. Lanthanum acetylacetonate (acac), and manganese acetylacetonate powder are combined with a mixture of ethylene glycol and methanol to create an organic slurry. The addition of an aqueous polyvinyl alcohol solution coated onto the substrate improves the adhesion of the lanthanum manganite to the alumina. Using the procedure from the Journal of American Ceramic Society Vol. 80, Issue 10, 1997, lanthanum manganite was synthesized and confirmed by XRD. The current challenge is to apply by dip coating, a thin and well-distributed film of the LaMnO_3 onto the substrate. Further studies will include a Thermogravimetric Analysis and Differential Thermal Analysis in order to determine at exactly what temperature the phase change of LaMnO_3 occurs. Additionally we will try to adhere a sol-gel cathode onto a YSZ electrolyte (Yttria stabilized Zirconia), which is currently being used as SOFC electrolyte. This will allow the observation of this process in a "real world" application.

INTERNATIONAL POLITICAL ECONOMY

Session Moderator: Christine Ingebritsen, Scandinavian Studies
Student Moderator: Emily Beyer, Creative Writing, Recent UW Graduate

EFFECTS OF REGIONAL INTEGRATION ON TRADE FLOWS IN THE AMERICAS

JORGE ROBERTS, Economics and Business, Senior, MARY GATES SCHOLAR, PRESIDENTIAL SCHOLAR,
MCNAIR SCHOLAR
THEO EICHER, *Economics*

The end of the XX century saw a revival of regional economic agreements in the Americas. One of the main goals of these agreements was to increase the trade between the member countries. During this period, trade increased throughout the Americas. This study shows that most of the multilateral agreements have had a significant impact to this increase and shows that none of the bilateral agreements have been significant.

FRANCO-GERMAN RELATIONS IN THE EUROPEAN UNION AS AFFECTED BY THE "GERMAN QUESTION"

COREY CAMPION, French and German, Senior at Washington State University
JOAN GRENIER-WINTHER, *French, Washington State University*

This thesis explores several issues concerning the "German Question" and its affect on Franco-German relations in the European Union. The analysis first focuses on the French side of the "German Question" and the French fear of a resurgent German assertiveness in the European political arena. Do the French truly fear a Fourth Reich or are they suffering from their own identity crisis given their lack of economic and demographic leverage in unified Europe? The second portion of the thesis focuses on the German side of the "German Question," exploring the issue of national identity in Germany today. Is a Fourth Reich truly possible given Germany's national insecurity and its struggles with the guilt of the past? Having analyzed the views of various authors concerning both the French and German sides of the "German Question," some conclusions are drawn concerning the future advancement of Franco-German relations in unified Europe. Based on the above-proposed analysis how might France better view Germany and its role in the EU? How might Germany better view itself in this role?

WHY DEVELOPING COUNTRIES AREN'T DEVELOPING

CATHY LEE, Political Science, Junior at University of California, Los Angeles
SUSANNE LOHMANN, *University of California, Los Angeles*

Arms sales, foreign aid and private investment that spread arms in developing countries undermine development. It is not only the developing countries that are responsible for underdevelopment but also the developed countries, their corporations and their citizens. Supplying weapons to developing countries gives power to oppressive regimes and terrorists; it thereby prevents humanitarian goals from being achieved. To develop evidence for these claims, I draw on articles, books, and documentaries, and I employ data from USAID and the Office of Budget and Management. I calculate how much foreign aid is used for military and security purposes, on the one hand, and humanitarian aid on the other. I also show the relationship between arms transactions and human rights violations.

INTERNATIONAL POLITICAL ECONOMY

REFORMING THE WORLD BANK AND US FOREIGN AID POLICY

VANESSA ORTLAD, International Studies, Senior
REBECCA THORP, International Studies, Senior
MATTHEW KARWOSKI, International Studies, Senior
ANNA JACKSON, International Studies, Junior
NICOLE DES ROSIER, International Studies, Senior
BETSY ELFERS, International Studies, Senior
AMANDA BALDERSTON, International Studies, Senior
JASMINE MARWAHA, French and International Studies, Senior
CHRISTINE WONG, International Studies

In our research and analysis of the World Bank, we argue in favor of the institution's survival, in conjunction with a few necessary reforms, and for increased US support for the achievement of both World Bank poverty alleviation objectives and US long-term interests. The US, as the largest donor, has the most voting power in the Bank and holds a great deal of political influence in the World Bank. The Bank's organizational and project cycle structure has proven to be quite rigid and therefore largely unreceptive to ambitious internal reforms, yet gradual change remains a possibility if key World Bank leaders are motivated for change. Internally, we identified four areas in which the Bank is in most need of reform. These four areas are a need for greater transparency, increased accountability, better facilitation of local and NGO participation in project-planning and greater implementation of the Bank's relatively new development strategy, the Comprehensive Development Framework (CDF), and practice, the Poverty Reduction Strategy Papers (PRSP). Further analysis shows that the Bank has made notable efforts to become more transparent through the New Information Policy, accounting for problems in Bank projects through use of the Inspection Panel, inclusion of local groups in project-planning and a commitment to extend PRSPs to all highly-indebted poor countries. Historically, the US relationship with the Bank has been fragmented between poorly coordinated government agencies, subject to short-term foreign policy interests and, generally, not well defined. Therefore, we recommend an increase in US funding and greater US oversight of the World Bank. Integral to strengthening the US role is support for the continuation of current World Bank reforms. Specific recommendations are an improvement of coordination between executive and legislative branches in creating foreign policy, an increase in staff of the Treasury Department's Office of Multilateral Development Bank Operations, a shift of all MDB offices to the State Department and better communications between NGO and the executive branch through current legislation.

INTERNATIONAL POLITICAL ECONOMY

THE SOCIOPOLITICS OF SEXWORK IN CUBA

MONICA HENESTROZA, Comparative Literature and Latin American Studies, Freshman at Stanford University
STANFORD PRESIDENT SCHOLAR, MELLON MINORITY UNDERGRADUATE FELLOW

MARK MANCALL, *History, Stanford University*

The Cuban government's need to compensate for the funds of socialist allies that were lost following the fall of the Soviet bloc prompted a marked influx of tourism that has dramatically changed the country's social contours. The capital of La Habana has become almost surreal: the opulent world of foreign tourists and business entrepreneurs who settle upon this tropical Caribbean island exists within the same spaces as the more Spartan world of Cubans who will never leave their island. Increasingly, men and women turn to the trade of *jineterismo*, a Cuban term that resembles hustling. *Jineteros* can include a wide range of people: from escorts and prostitutes, to individuals running cigar scams, to couples that rent their bed at night to street prostitutes and their clients. Many *jineteros* hustle in order to procure dollars and luxuries for which the Cuban peso-based stipend does not allow. And whereas renting your bed to a prostitute was previously a sign of destitution, such transactions can now allow you to live decadently by national standards. Yet the situation of those *jineteros* who are sexworkers reveals that *jineterismo* in Cuba can be sparked by more than economic incentive: many of these (young) people enjoy their work because it puts them in direct contact with the international "other." The effects of intersecting racial, socioeconomic, gendered, sexual and international hierarchies on *jineterismo* in Cuba are unquestionable. Even as *jineterismo* serves as a means for Cubans to return capital to their country by manipulating the imperialist stereotypes that were used to exploit their land and their people, a continuing dependence on foreign capital could prove fatal to the health of national identity: every day this trend expands, it becomes more difficult for Cuba to stop being *jineteando* itself.

LIVING SYSTEMS: A

Session Moderator: Frieda Taub, Aquatic and Fishery Sciences
Student Moderator: Anne Williams, Aquatic and Fishery Sciences, Junior

MIGRATION PATTERNS OF SOCKEYE SALMON FROM SOUTHWEST ALASKA

ANNE WILLIAMS, Aquatic and Fishery Sciences, Junior
THOMAS QUINN, Aquatic and Fishery Sciences
DANIEL SCHINDLER, Zoology

Management of salmon fisheries require descriptions of the timing of adult returns to spawning grounds (escapement). To distribute fishery exploitation among different population components that may migrate through rivers at different times, we must accurately quantify the temporal patterns of salmon migration. Sockeye run abundance and timing can be estimated from repeated aerial surveys, fishery catches, and systematic counts either en route to or on spawning grounds. Escapement estimates of sockeye salmon returning to Lake Clark through the Newhalen River in southwest Alaska have been performed by the Alaska Department of Fish and Game since the 1940s. The Fisheries Research Institute has enumerated sockeye on the Newhalen River since 1979. I hypothesized that annual sockeye migrations through the Newhalen River are characterized by a bimodal distribution that reflects the contributions from two major spawning populations. I used the likelihood ratio test to determine whether the data provided evidence for a bimodal or a unimodal run in each survey year. Results indicated that counts were terminated prematurely in many years, which prevented the detection of a multimodal run. When counting extended over a longer season, evidence for bimodality was apparent. I conclude that counting procedures must extend over the entire migration season to properly characterize the escapement pattern of these sockeye populations.

FISH SURVEYS IN THE SAN JUAN ARCHIPELAGO: COMPARING FISH DENSITIES WITH DRIFT CARD ACCUMULATION AND VEGETATION TYPE

COLLEEN WEISER, Biology: Ecology, Evolution, and Conservation, Senior, MARY GATES SCHOLAR,
HOWARD HUGHES SCHOLAR, SPACE GRANT SCHOLAR
BRUCE MILLER, Aquatic and Fishery Sciences
DON GUNDERSON, Aquatic and Fishery Sciences

This project was based on a drift card study and vegetation survey. The drift card study used drift cards as models for fish larvae and showed areas of high and low drift card accumulation around the San Juan Archipelago. I wanted to determine if there was a higher density of fish in high drift card accumulation areas. The vegetation survey project produced GIS maps of the vegetation at five high accumulation sites and three low accumulation sites. I wanted to see if there were higher fish densities or certain fish species associated with particular vegetation types. Two pairs of high/low drift card accumulation sites were surveyed for fish and vegetation. Transects at each site were surveyed for fish using a small otter trawl on the R/V Scoter. Fish were identified, counted, measured and fish densities were calculated using a spreadsheet. Vegetation was then surveyed along the same transect using an underwater camera towed from the research vessel. Fish assemblages were different at all sites, but these differences did not seem to correlate with drift card accumulation or vegetation type. There was no correlation between species richness and drift card accumulation. Total mean fish densities were not significantly different between high and low drift card accumulation sites. This may indicate that fish larvae do not drift quite as passively as sometimes thought. Mean total fish densities were higher in areas with mixed vegetation than in areas dominated by one type of vegetation. This indicates that more complexly vegetated areas may provide better protection from predators and therefore contain higher densities of fish and a greater number of fish species. This information has potential applications in choosing target areas for protection to maximize species diversity.

LIVING SYSTEMS: A

FLYING INSECTS CARRY NUTRIENTS FROM SPAWNING SALMON INTO STREAMSIDE FORESTS

TESSA FRANCIS, Wildlife Science, Senior
DANIEL SCHINDLER, Zoology

Pacific salmon (*Oncorhynchus* spp) may play keystone roles in freshwater ecosystems. Because salmon gain most of their mass in the ocean and then die after spawning in freshwater ecosystems, nutrient and energy inputs in the form of salmon eggs and body tissues may be a critical subsidy for maintaining the productivity of aquatic and streamside (riparian) ecosystems. The goal of my research was to evaluate the importance of salmon resources in subsidizing aquatic insect abundance. Because these organisms disperse via flight after emerging from streams, they may be an important prey for terrestrial predators in riparian forests. I sampled four streams in southwestern Alaska in the summer of 2001; two streams with salmon and two streams that historically do not support salmon. On each stream, I sampled flying insects at varying distances from the stream edge to determine the extent to which insects transported salmon-derived nutrients into riparian forests. Aquatic insect emergence rates on salmon-bearing streams were up to 10 times higher than on streams without salmon. However, aquatic invertebrate dispersal was limited to a distance of 50 meters into riparian forests. Using natural isotope characteristics, and based on these emergence and dispersal data, I determined the extent to which salmon-derived nutrients are distributed by aquatic invertebrates into riparian ecosystems along salmon streams. Aquatic invertebrates transport salmon-derived nutrients into riparian zones but these effects appear to be limited to the area within 50 meters of stream banks.

SPECIES COMPOSITION IN THE NEARSHORE FISH ASSEMBLAGES AT POINT GEORGE, SHAW ISLAND, WASHINGTON

BROOKE MARTIN, Aquatic and Fishery Sciences, Senior, MCNAIR SCHOLAR
BRUCE MILLER, Aquatic and Fishery Sciences
DONALD GUNDERSON, Aquatic and Fishery Sciences

Dive (SCUBA) surveys were conducted using a subtidal zigzag transect to examine the fish assemblage at Point George, Shaw Island, Washington. Data from these surveys were used to compare densities for the seven target species designated by the San Juan County Marine Resource Committee: *Sebastes caurinus*, *S. emphaeus*, *S. flavidus*, *S. melanops*, *S. maliger*, *Ophiodon elongates*, and *Hexagrammos decagrammus*. Densities were compared to fall data from previous surveys conducted in 1974/75, 1991, and 1999. *Sebastes flavidus*, *S. melanops* have declined significantly since 1974 ($p = 0.01$, $p < 0.05$). *Sebastes maliger* has shown a significant increase from 1999 to 2001 ($p = 0.01$). Densities of *S. caurinus*, and *H. decagrammus* have increased significantly since 1974 ($p = 0.04$, $p = 0.01$). *Ophiodon elongates* densities varied significantly with year ($p = 0.03$). *Sebastes emphaeus* have shown significant increase in density between 1974/75 and 1999 ($p < 0.01$) and a decrease from 1999 to 2000 ($p = 0.01$). The combined densities of non-schooling species have not significantly changed since 1974. Marine mammal predations along with other factors are indicated sources of decline of the target species. Point George has been surveyed several times since 1974, which provides a historical data set. Point George has been a marine reserve since 1990 and offers a unique opportunity to study the subtidal community overtime.

LIVING SYSTEMS: A

TRAPPING SURVEY OF DIFFERENT VEGETATION TYPES: HABITAT ASSOCIATIONS OF JUVENILE SPOT PRAWNS, PANDALUS PLATYCEROS, AND OTHER ORGANISMS IN THE SAN JUAN ISLANDS

DIANA MCHUGH, Biology: Ecology, Evolution, and Conservation, Senior, MARY GATES SCHOLAR
DONALD GUNDERSON, *Aquatic and Fishery Sciences*

The spot prawn, *Pandalus platyceros*, is a commercially important species, and most research has focused on adult distributions. A trapping survey was carried out in the San Juan Islands to determine the vegetation preferences of spot prawn juveniles and to investigate the usefulness of trapping surveys in linking bottom type and community structure. I found that spot juveniles are most abundant in areas of dense cover. Their average carapace length (CL) for all areas was 18mm with no significant difference between sites and a small variance within and between sites. This suggests that they only use the habitats sampled for one stage in their life cycle. Humpback shrimp, *P. goniurus*, and dock shrimp, *P. danae*, were also surveyed. Traps are a useful tool in surveying for shrimps, crabs, and sculpins.

LIVING SYSTEMS: B

Session Moderator: Billie Swalla, Zoology
Student Moderator: Brooks Miner, Zoology, Junior

A FULL-COLOR PHOTOGRAPHIC DESCRIPTION OF POSTPARTUM UTERINE INVOLUTION IN THE DAIRY COW

CHRISTINA MARIE DAVIS, Animal Science, Senior at Washington State University
PHILLIP L. SENGER, Animal Science

The goal of this project was to develop a chronological series of full-color photographs describing uterine involution in the dairy cow. Reproductive tracts were removed following slaughter from cows on days 1, 4, 10, 15, and 20 after parturition. Each reproductive tract was photographed while in situ so that the size relationship to the body cavity could be observed. Following excision, photographs illustrating the composition of intact ovaries, sliced ovaries, the incised uterus, the caruncular tissue, myometrium, and the cervix were taken. Photographs representing each stage (days one, four, 10, 15, and 20) of involution are presented in a manner that will enable the reader to compare anatomical changes as a function of time.

FELINE HYPERTHYROIDISM: A BREED PREDISPOSITION?

CHRISTINA SMITH, Veterinary Science, Senior at Washington State University
RANCE SELLON, Veterinary Clinical Sciences, Washington State University

Hyperthyroidism is among the most common endocrinopathies affecting cats today. Since it was first described as a clinical disease in 1979, it has become an increasingly frequent diagnosis in small animal clinics and a popular research topic. This research has led to extensive knowledge regarding the pathology, pathophysiology, clinical problems, and treatment options for hyperthyroidism. Yet, all the research to date has not clarified the etiology of hyperthyroidism. It is thought that nutritional, environmental, infectious, immunologic and/or genetic factors may play a role, but no definitive cause has been established. Two studies, performed eleven years apart, have tried to shed light on the etiology of hyperthyroidism by identifying risk factors associated with the development of the disease (Scarlett et al, Kass et al). The first study, published in 1988 by Scarlett et al, found that non-Siamese cats were approximately, "10 times more likely to develop hyperthyroidism than Siamese cats" (Scarlett et al, 301-02). The second study, published in 1999 by Kass et al, was aimed at expanding the observations of the 1988 study. The results of this study showed that Himalayan and Siamese cats had a decreased risk of hyperthyroidism as compared to domestic shorthaired cats. In contrast, no other breed was associated with either an increased or a decreased risk. The possibility of a reduced risk of hyperthyroidism among Siamese cats, as proposed by these two studies, is intriguing because it implies the presence of a protective factor in their life, be it a genetic difference or a lack of exposure to some etiologic agent. If the former is protective, identification of the specific, unique genetic element could lead to the identification of the exact etiology of hyperthyroidism. This would have important implications for the future treatment of the disease, opening up the possibility of gene therapy and perhaps a form of preventative treatment or lifestyle for those at risk. Due to the importance of these implications, this study was developed in an attempt to replicate, and thereby support, the results of these two studies. The results of the study, conducted at the Washington State University Veterinary Teaching Hospital, showed no indication of a relationship between Siamese cats and hyperthyroidism, but did show an unanticipated relationship between coat color and hyperthyroidism. Though these results do not support the findings of the previous two studies, they still indicate that genetics, specifically those involved in coat color determination, may play a role in the etiology of hyperthyroidism.

LIVING SYSTEMS: B

FEMALE-FEMALE AGGRESSION IN A HIGH ARCTIC BREEDING SONGBIRD

BROOKS MINER, Zoology, Junior, MARY GATES SCHOLAR, HOWARD HUGHES SCHOLAR
JOHN WINGFIELD, Zoology
SHARON LYNN, Zoology

Within a species, aggression between individual birds is a common feature of avian social interactions. This behavior generally results from competition for resources such as territories, food, or access to mates. Aggression can occur within or between sexes, and can be initiated by males or females. Female-female aggression is known to occur in various bird species, yet this behavior is less well studied than male aggression. Currently, studies of the environmental causes and hormonal control of female-female aggression are limited in number. We examined the occurrence of female-female aggression in a population of Snow buntings (*Plectrophenax nivalis*) breeding at Barrow, Alaska (71.3° N, 156.8° W), where the brief arctic breeding season and limited nest site availability may increase aggression between individuals. This study is the first assessment of female-female aggression in an arctic breeding bird. We measured female-female aggression by performing simulated territorial intrusions at five Snow bunting nests during the nestling stage. We presented female Snow bunting decoys and female Lapland longspur decoys (controls) in cages within five meters of each nest and recorded aggressive behaviors directed toward the intruder by the focal female. Our results clearly indicate that female-female aggression does occur in Snow buntings, as focal females only exhibited aggressive behaviors toward Snow bunting decoys. We will return to Barrow in the summer of 2002 to expand the current study by investigating the hormonal basis of this behavior. Testosterone is a potent regulator of aggression in male birds, and we expect that it plays a similar role in regulating female aggression.

WHY DO FEMALE MAGELLANIC PENGUINS LAY EGGS OF DIFFERENT SIZES? DETERMINING THE EFFECTS OF FEMALE AGE AND LAYING DATE

NICOLE RAFFERTY, Biology: Ecology, Evolution, and Conservation, Junior
DEE BOERSMA, Zoology

The Magellanic penguin (*Spheniscus magellanicus*) is a long-lived temperate species, the largest population of which has declined by 35 percent in the last two decades. An 18-year data set on these seabirds is available from Punta Tombo, Argentina, where over 500,000 Magellanic penguins come to breed between September and April. We used these data to determine how factors, such as female age and egg laying date, relate to variation in egg size. Magellanic penguins typically lay two eggs in early to mid-October. While the first-laid egg is usually longer and narrower, the second tends to be shorter and wider. Disparity in egg size is referred to as egg-size dimorphism. Clutches were defined as dimorphic if the eggs differed by at least 17.6 cm³ (the equivalent of 10 grams difference in mass). In about 90 percent of the clutches (n=7,500), however, the first and second eggs are similar in size. We investigated whether dimorphism in egg size is more common in younger females and whether it is the first or the second egg that is larger when size dimorphism is present. We also tested the prediction that older, more experienced females are more efficient foragers than younger females, investing more in their eggs and consequently laying larger eggs. We found a positive linear relationship between female age and clutch volume from birds aged 4 to 14 years. Magellanic penguins live as long as thirty-five years, however, and it appears that senescence may outweigh experience for females over the age of 14 years because clutch volume decreases. The results of this research increase our understanding of factors that influence egg size variation and intraclutch dimorphism and their effect on the reproductive success of the Magellanic penguin. Understanding these dynamics can inform conservation efforts for this species.

LIVING SYSTEMS: B

THE ROLE OF INNATE IMMUNITY IN ASCIDIAN METAMORPHOSIS

ALIZA LLOYD, Zoology, Senior, MARY GATES SCHOLAR
MONIQUE MAYO, Cellular and Molecular Biology, Junior
BILLIE SWALLA, Zoology

We isolated mRNA transcripts expressed during metamorphosis by suppressive PCR subtractions, in the ascidian, or tunicate, *Boltenia villosa*. Fourteen of the isolated genes are potentially involved in innate immunity. Innate immunity is found in all animals, and is a non-specific immune response. The expression of innate immune related transcripts is especially interesting because they are expressed during metamorphosis from a tadpole larva with the chordate distinguishing characteristics (dorsal hollow nerve chord, notochord, post anal tail) to a sessile, benthic, and filter-feeding adult ascidian. We hypothesize that some of these transcripts may have very important and/or strict roles in the settlement and metamorphosis of the larvae. We have further examined three genes; including *Coronin*, *p-Selectin*, and a *Toll*-like leucine rich repeat. The expression of these genes, as seen in our *in-situ* hybridization results, is very clearly activated while settlement occurs. We hypothesize that an innate immune response may underlie the rapid and dramatic migration of blood cells across the epidermis that occurs in the initiation of metamorphosis during settlement of the larvae. We are currently conducting experiments to test this hypothesis.

LIVING SYSTEMS: AQUATIC DISEASES AND TOXICANTS

Session Moderator: Christian Grue, Aquatic and Fishery Sciences

Student Moderator: Jennifer Hempelmann, Zoology, Senior

ABIOTIC FACTORS CONTROLLING THE DISTRIBUTION OF TWO SPECIES OF *MIMULUS*

KRISTY BRADY, Botany and Biology: Ecology, Evolution, and Conservation, Senior, MARY GATES SCHOLAR

DOUGLAS SCHEMSKE, Plant Biology

TOBY BRADSHAW, Botany

Abiotic factors, such as temperature, are important in determining species distribution. Such elements function as instruments of natural selection and can thus contribute to speciation through creation of reproductive isolation. In the Sierra Nevada Mountains, two closely related species of *Mimulus* coexist in a narrow region at mid-elevation; however, despite being interfertile, hybrids of these two species are seldom found in nature. It is hypothesized that both biotic and abiotic influences contribute to the maintenance of these two species. For instance, it has been demonstrated in previous studies that pollinator preference contributes to their reproductive isolation. Currently, adaptation to temperature is being studied as a factor contributing to the reproductive barrier between *Mimulus lewisii*, which occurs from mid- to high-elevations, and *M. cardinalis*, occurring from low- to mid-elevations. This is being examined from two approaches. First, at the seedling stage, both species were placed in a growth chamber and subjected to a peak temperature (e.g. 38°C) lasting four hours a day for a varying number of days (one day, two, four, and seven days). Shoot biomass and percent mortality were calculated to determine adaptiveness to high temperatures. Additionally, in the Sierras, survival of *M. lewisii*, *M. cardinalis*, and second generation hybrids planted in common gardens at various elevations is currently being monitored and will be used to determine adaptiveness to elevation. Results from these studies will further our understanding of the ecological factors that limit distribution of these two species and promote the reproductive barrier between them.

EPIZOOTIOLOGY OF VIRAL ERYTHROCYTIC NECROSIS (VEN) IN PACIFIC HERRING (*CLUPEA PALLASI*)

JENNIFER HEMPELMANN, Zoology, Senior, MARY GATES SCHOLAR

RICHARD M. KOCAN, Aquatic and Fishery Sciences

PAUL K. HERSHBERGER, Aquatic and Fishery Sciences

Viral erythrocytic necrosis (VEN) is a blood disease affecting many teleost fish species worldwide. The disease is caused by a group of viruses referred to as erythrocytic necrosis viruses. Clinical VEN is diagnosed by the presence of visible inclusion bodies found within the cytoplasm of red blood cells. Many conditions have been associated with the virus, including increased red blood cell lysis, reduced hematocrit, increased blood clotting times, and anemia (Eiras et al. 1996). VEN may also cause a reduced resistance to other infective agents and an increased sensitivity to environmental stressors (Meyers et al. 1986). Little is known about the development and spread of erythrocytic necrosis viruses. The primary objective of this study was to follow the course of VEN in a population of Pacific herring (*Clupea pallasii*) from the waters surrounding San Juan Island, Washington. Results showed that the intensity of VEN infections among wild Pacific herring increased with confinement time in laboratory tanks. Among wild herring populations, the condition likely occurs as a latent infection because 100% of newly captured herring tested positive for the virus, at a low intensity of infection. Clinical VEN peaked on day 16 of captivity, when an average of 50% of the blood cells showed VEN characteristic inclusion bodies, with many individual herring exhibiting inclusions in 90 to 100% of their red blood cells. While no mortalities were recorded as a result of the virus or any other pathogens, the extreme intensity of infection exhibited by many individual fish may significantly affect herring survival in the wild. Attempts to demonstrate passive immunity to the virus, interspecies horizontal transmission by cohabitation, and viability of the virus in seawater were all inconclusive.

LIVING SYSTEMS: AQUATIC DISEASES AND TOXICANTS

ICHTHYOPHONUS HOFERI: DIFFERENTIAL SUSCEPTIBILITY OF DEMERSAL MARINE FISHES

LINDSAY OVERTON, Biology, Senior, MARY GATES SCHOLAR
RICHARD KOCAN, Aquatic and Fishery Sciences
PAUL HERSHBERGER, Aquatic and Fishery Sciences

Although natural infections of *Ichthyophonus hoferi* (*I. hoferi*) have been confirmed in only a few species of Puget Sound flat fishes, laboratory challenge with the parasite showed a number of species to be susceptible. *I. hoferi* infections are caused by a protistan parasite that occur ubiquitously over a wide host range. Of the fish used for this study, *I. hoferi* is only found naturally in the Pacific sand dab (*Citharichthys sordidus*) and speckled sand dab (*Cithanichthys stigmaeus*) throughout the San Juan Archipelago. However, other species of flat fishes can be experimentally infected with *I. hoferi*, including the English sole (*Parophrys vetulus*), butter sole (*Isopsetta isolepis*), rock sole (*Lepidopsetta bilineatus*) and flathead sole (*Hippoglossoides elassodon*). The giant skate (*Raja binoculata*), lingcod (*Ophiodon elongatus*), and sand sole (*Psettichthys melanostictus*) could not be infected with *I. hoferi*. In addition, great sculpins (*Myoxocephalus polyacanthocephalus*) placed in the tanks with experimentally infected fish did not become infected.

PREVALENCE AND DESCRIPTION OF AN INTRAERYTHROCYTIC PARASITE IN THE SPINY DOGFISH, *SQUALUS ACANTHIAS*

ANDREA CLEWLEY, Zoology and Biology: Ecology, Evolution, and Conservation, Senior,
MARY GATES SCHOLAR
PAUL HERSHBERGER, Aquatic and Fisheries Sciences

An unknown intra-erythrocytic parasite was detected in the cytoplasm of red blood cells of *Squalus acanthias*. The parasite is between 2-6 μm in size and has a purple nucleus surrounded by blue cytoplasm. Although the lifecycle was not determined, several intra and extra-cellular stages were found. The parasite did not appear to have any adverse effect on the host. Currently, 18s rDNA studies are underway to determine the identity of the parasite.

LIVING SYSTEMS: AQUATIC DISEASES AND TOXICANTS

TOXICITY OF FOUR SURFACTANTS TO JUVENILE RAINBOW TROUT: IMPLICATIONS FOR OVER-WATER USE IN WASHINGTON STATE – FISH 455/ESC 457

JENNIFER CABARRUS, Aquatic and Fishery Sciences, Senior
CHRISTIAN GRUE, Aquatic and Fishery Sciences
BRIDGET SMITH, Aquatic and Fishery Sciences
JENIFER NCINTYRE, Aquatic and Fishery Sciences
VICKI WONG, Forest Resources

Herbicides are frequently used to control exotic or nuisance aquatic plants. Utilization of herbicides in Integrated Pest Management (IPM) Plans to control aquatic weeds has been hampered by court injunctions directed at the non-target toxicity of active herbicidal ingredients. However, surfactants frequently represent the most toxic component of herbicide tank mixes and can be orders of magnitude more toxic than the active ingredient. The aquatic toxicity of surfactants needs to be assessed, particularly in light of new State permitting processes in response to a recent Federal Court ruling. This ruling requires states to issue National Pollutant Discharge Elimination System permits for the use of herbicides and recommended surfactants in aquatic systems. Unfortunately, adequate data on the toxicity of surfactants to aquatic resources are lacking, thereby threatening the permitting process and the success of IPM strategies. Our objective was to develop dose response curves (immobility and mortality) for juvenile rainbow trout (*Oncorhynchus mykiss*) exposed to four surfactants either currently in use (R-11®; LI700®), or proposed for use (AGRI-DEX®; HASTEN®) in aquatic systems in Washington State. Static 96-h acute toxicity tests were conducted during January - March 2002 using a standard EPA protocol. R-11® was found to be the most toxic (LC50=5.76±SE=0.13 ppm, EC50immobility=3.92±0.12) followed by LI700® (LC50=17.2±0.55), HASTEN® (LC50=73.8±1.36, EC50=67.7±0.63), AGRI-DEX® (LC50=271±17.3). When mortality occurred, fish succumbed within the first 24 hours. Fish that ultimately survived exposure to toxic concentrations of R-11® and HASTEN® became immobile, gilling and resting on their backs at the bottom of the test chambers. LI700® is considered the safest of the surfactants currently approved for over water use. However, our results indicate that it is more toxic than HASTEN® and AGRI-DEX®. Assuming equivalent efficacy, we recommend AGRI-DEX® over the other three surfactants.

USING MICROSATELLITES TO EXPLORE GENETIC DIVERSITY IN RED TIDE FORMING ALGAE

ADAM LAUSCHE, Chemical Engineering, Senior, MARY GATES SCHOLAR
E. VIRGINIA ARMBRUST, Oceanography
TATIANA RYNEARSON, Oceanography

Dinoflagellates are single-celled, photosynthetic algae that live in the surface layer of the oceans. Several dinoflagellate species are known to form red tides that can be harmful to both marine life and humans. Despite extensive research in the area of red tides, these phenomena remain unpredictable. In order to better understand how red tides develop, we are examining the genetic diversity of populations of the red tide forming dinoflagellate *Prorocentrum micans*. All cells of this species look the same, making it impossible to determine genetic diversity based on appearance. Instead, we searched the *P. micans* genome for microsatellites, regions of DNA that can vary in length between individuals. Microsatellites are commonly used in genetic diversity studies of mammals and fish, but had not been identified previously in any dinoflagellate species. Using a suite of molecular techniques we examined 128 regions of the *P. micans* genome and identified 58 microsatellites. We are currently working with one microsatellite extensively to determine if this region can be used to identify genetic differences between dinoflagellates. The next step is to use this microsatellite to determine the genetic diversity of *P. micans* field populations sampled from the waters of southern California. By learning about how the diversity of a population changes over time, we can better understand how potentially toxic dinoflagellates interact with the environment.

MEDICAL SCIENCES

Session Moderator: Tom Daniel, Zoology

Student Moderator: Jeff Longnion, Electrical Engineering and Neurobiology, Senior

ACETABULARIA ACETABULUM: A NOVEL MODEL FOR ARSENIC TOXICITY

NIMA DEJBOD, Zoology, Sophomore

LYNNE TOWNSEND, Neurobiology, Senior, MARY GATES SCHOLAR

DINA MANDOLI, Botany and Developmental Biology

Arsenic is a ubiquitous environmental carcinogen. Chronic low-dose exposure can elevate the risk of diabetes and lead to skin lesions and tumors in humans. Up to 30 million people in Bangladesh are in danger of developing arsenic-related illnesses as a consequence of drinking heavily contaminated groundwater. In the United States, widespread pesticide use has caused large quantities of arsenic to be leached into the soil, air, and water. The mechanisms of arsenic-related disease are poorly understood. At the root of this ignorance is the fact that no adequate models have been developed to fully explore the effects of arsenic in living biological systems. *Acetabularia acetabulum* is an excellent model for arsenic toxicity because it affords the study of input, flow-through, and bioaccumulation of arsenicals. Furthermore, arsenicals are chemically stable in the culture media over long periods of time and permit extended studies. We have determined the dose response to arsenic intermediates in the human detoxification pathway. Effective doses closely follow the sensitivity ranges of humans, and the hierarchy of toxicity of intermediates in *A. acetabulum* mimics that in humans. In addition, BAL, DMSA, DMPS, Penicillamine, Cysteine, and Glutathione chelate trivalent arsenicals and significantly delay the onset of MMA III-induced death in *A. acetabulum*. To further explore the activity of arsenic in a biological context, we are using Xray absorption spectroscopy to generate in situ two-dimensional images of arsenic speciation and subcellular localization. Based on this evidence, we believe that *A. acetabulum* has the potential to serve as an excellent model both for the exploration of arsenic biology and as a system in which to develop and test novel arsenic chelators.

DEVELOPING DIRECT CURRENT ELECTROENCEPHALOGRAPHY (DC-EEG) INTO A CLINICAL INVESTIGATION METHOD

ASANKA DEWARAJA, Bio-Engineering, Junior

JOHN MILLER, Neurology

I participate in a research project that aims at developing direct current electroencephalography (DC-EEG) into a clinical investigation method. This is conducted at Harborview Medical Center in collaboration with the University of Helsinki (Finland). My own project has been to study characteristics of the slow brain responses (DC-shifts) to visual stimuli, which have not been studied before due to technical difficulties related to DC-EEG recordings. We have shown that very long latency responses (DC-shifts; length up to 10sec, amplitude 5-20 μ V) are easily elicited by flashing light at frequencies above 2Hz and less than 30Hz. Very slow (1Hz) or high frequencies (>30Hz) do not elicit these responses. It seems that these DC-shift are not limited to primary visual cortex, and they are not affected by hypocapnia (i.e. hyperventilation), which is otherwise well known to have powerful influence on nervous excitability. A remarkable feature of these responses is also that they require averaging of only 5-10 trials, which is very rare in evoked potential research. We propose that these slow DC-shifts represent a summation of the widespread, polysynaptic evoked responses (latencies over 300ms) shown in a number of previous studies. These responses are clear and they are relatively ease to obtain (i.e. small number of averages needed, easy recording set-up, and co-operation not required). Flash evoked DC-shifts might turn out to be useful clinical tools when functional integrity of the cerebral cortex needs to be studied, for instance during anaesthesia or coma.

ANALYSIS OF VOCAL CORD PARALYSIS: THE DEVELOPMENT OF A CLINICAL MEASUREMENT OF AIRFLOW RESISTANCE

JEFF LONGNION Electrical Engineering and Neurobiology, Senior, MARY GATES SCHOLAR
TOM DANIEL, Zoology

With causes including head trauma, viral infection, and aging, vocal cord paralysis (VCP) is a common disorder, which, depending on the severity of paralysis, can result in anything from a slight impairment of speech to the potentially fatal prevention of respiration. Traditional clinical treatments for the decreased airflow typical of VCP include removal or reshaping of the vocal cords, which can lead to compromised speech. More promising alternatives include renevation or electrical stimulation of the vocal cords. Unfortunately though, the effectiveness of treatments is currently only verified by a pulmonary function test, which is a subjective measure of breathing ability, not an objective measure of airflow resistance. So, in order to develop new treatments and verify existing ones, we seek an objective clinical metric of airway resistance. Towards this end we measured airflow and subglottal pressure in 20 normal persons with no known respiration problems and 3 patients with known pathologies. Fitted with a pressure-transducing needle inserted subglottally and an airflow meter, each subject was asked to begin breathing softly and slowly increase effort over the period of a minute. The simultaneous records of pressure and flow were used to compute airway resistance. Our analyses show the maximum pressure generated by patients and normal subjects did not differ ($p \ll .05$). Patients with known vocal cord disease, however, had significantly lower maximum flows during their experiments ($p \ll .05$). Also, patients had significantly higher airflow resistances than normal subjects ($p \ll .05$), but airflow resistances in both patients and normal subjects did not significantly vary with effort ($p \ll .05$). Furthermore, a patient measured after corrective surgery demonstrated resistance values comparable to normals. These results suggest that this method could be a valuable means of determining treatment efficacy and, more importantly for our future research interests, a critical step in the development of vocal cord stimulation technologies.

MEDICAL SCIENCES

HETEROMERIC PROTEIN ASSOCIATIONS OF SORTING NEXIN 7

SARAH PRICHARD, Zoology, Senior
TONY PARKS, Pathology

Within the body, the workings of each cell are controlled by complex cascades of hormones, growth factors, and second messengers. Although microscopic in scale, these signaling pathways are as vital to our survival as the flow of blood through the heart. For example, transforming growth factor- β (TGF- β), epidermal growth factor (EGF), and insulin regulate signaling cascades involved in cell proliferation, differentiation, and wound healing. It is the corruption of these pathways that leads to many significant diseases including cancer and diabetes. Although research has established the powerful influence of these growth factors and their receptors on cellular processes, relatively little is known about their transport within the cell. My project focuses on sorting nexins (SNX), a family of proteins implicated in the intracellular trafficking of these (and other) growth factor receptors. Studies of SNX1-4 and 6 have documented interactions with TGF- β , EGF, and insulin, as well as strong associations with the early endosome, an organelle involved in the sorting and trafficking of membrane proteins. The sorting nexins are thought to direct the transportation and degradation of membrane receptors, indirectly influencing the strength of signals through various signaling pathways. My project utilized overexpression experiments to identify proteins associating with a novel sorting nexin, SNX7. COS-1 cells were transfected with sorting nexin expression vectors, and the resulting cell lysates were immunoprecipitated with antibodies against SNXs 1-6. The immunoprecipitated proteins were then assayed in Western blots for association with SNX7. Sorting nexins 1, 2, and 6 all interacted strongly with SNX7, suggesting that these proteins function in a multimeric complex. By defining the complexes within which the sorting nexins function, we can shed light on how sorting nexins modulate receptor trafficking and signaling. Ultimately these studies may provide insight into the cellular mechanisms that underlie major diseases such as cancer and atherosclerosis.

MUSCLE REPAIR: SKELETAL MYOBLAST MOTILITY ON LAMININ PATTERNED SURFACES

TOVAH KERR, Biochemistry, Microbiology, and History, Senior, MARY GATES SCHOLAR, HOWARD HUGHES SCHOLAR
STEPHEN D. HAUSCHKA, Biochemistry
JOHN C. ANGELLO, Biochemistry

The skeletal muscles of mammals are limited in their repair functions. If large areas of muscle are damaged, due to trauma, normal function is usually not restored. However, skeletal muscle can repair small-scale tissue damage using endogenous stem-like cells called "satellite cells". Satellite cells, which are normally quiescent, can be stimulated to become proliferating (dividing) muscle precursors or "myoblasts", which eventually differentiate and fuse to fully functional skeletal muscle. We are working to engineer muscle replacement grafts to help heal large-scale skeletal muscle damage and restore normal function. One approach to creating muscle grafts is by mimicking the pathway used by nature to repair muscle. Extra-cellular matrices are a complex mixture of proteins, lipids, fluid, and other molecules, which surround muscle fibers and contribute to its normal and muscle repair functions. Laminin is one such extra-cellular protein that affects satellite cell and myoblast motility in addition to cell attachment. Understanding how myoblasts attach, migrate, divide, and fuse on biomaterials is critical to developing functional engineered skeletal muscle tissue. In this study we used a permanent myoblast cell line (MM14) derived from adult mouse skeletal muscle. With the aid of video microscopy and imaging software, we examined myoblast motility on varying concentrations of the extracellular matrix protein, laminin. To accomplish this, the cells were spatially restricted on linear lanes of laminin, created using micropatterning techniques. Two objectives in the study were (a) to determine the laminin concentration(s) that permit the fastest cell migration, and (b) to determine whether myoblast cell motility changes over time in culture. It was determined that cells moved fastest on lanes created by adsorption of 45mg/ml or greater laminin, and that maximal myoblast migration velocities are maintained for at least 24 hours.

MEDICAL SCIENCES

RADIATION DETECTION

MARLEEN MARTINEZ, Pre-Engineering, Freshman, SPACE GRANT SCHOLAR
MATHEW MOREY, Aerospace Engineering, Freshman
KELLEY TOWNE, Aerospace Engineering, Sophomore
TAI-CHANG CHEN, Electrical Engineering
MARY COOK, Engineering

The general goal of the project is to produce a functional radiation detection device that can be used in a medical setting. We will be working directly with radiation and using the principals of solid state physics in our development of the device. Not only is radiation found in hospitals, it is also present in the environment, as a potential contaminant of ground water, as well as in outer space. The kinds of radiation waves that are mostly encountered in a medical setting are gamma rays. Some sources of radiation are radioactive materials that are used in nuclear medicine and x-ray machines. In our lab, we only have gamma rays to experiment with, so we chose the medical setting as our target for the product we develop. Currently, hospitals use detection devices that are film badges worn by the technician or worker who is in contact with the radiation source. This badge is sent in once a month and the film is developed, revealing the amount of radiation it has been in contact with. This current method does not provide an instant readout of the radiation in an area and it has limits on its accuracy because it is only a visual readout. Our goal is to develop a more accurate device that gives an instant readout of radiation levels the moment they are happening. Our participation in this project will enhance our skills as engineers and benefit the community in the future. By using our intense research on the knowledge of our project and planning out our goals with a timeline for putting our work into progress, we hope to create a technical prototype that will be developed into an actual product for use in the real world.

SERIAL FMRI IN STROKE RECOVERY

HOANG NHAN, Neurobiology, Senior, MCNAIR SCHOLAR, PRESIDENTIAL SCHOLAR
STEVEN CRAMER, Neurology

Stroke is the number one cause of disability in America. Many studies have attempted to understand the mechanism underlying stroke recovery, one of which is the process of reorganization of surviving brain tissue. Most patients show some degree of clinical improvement, which generally reaches a plateau by 90 days after stroke. We hypothesize that there is a relationship between cerebral reorganization, time since stroke onset, and clinical status. Eight controls and 16 patients are studied twice, with the 2 patient studies occurring early and late after stroke. Brain activation in controls is assessed using both active and passive movement of the right index finger. Patients are assessed using active movement of either stroke-affected index finger, non-affected finger, or both. Passive movement of the stroke-affected finger will also be assessed for patients. Regions of interests will be defined, and for each task. Statistical map will be generated voxel-by-voxel using a t-test, contrasting images taken during active movements vs. rest. Individual analyses will compare between subject groups the number of voxels that pass a threshold of $z=3$ (approx $p<0.001$) within each region for a given task, for maps from both time points. To compare group average activation maps, statistical maps will be transformed into Talairach stereotaxic space, then averaged according to group. We expect to see that patients with good recovery will have an increase in contralateral primary sensorimotor cortex activation more so than patients with bad recovery, and that other regions will show few correlations. Disability after stroke remains an important clinical concern. The capacity to measure restorative events in the brain, including at early time points after injury, may permit on-going adjustment in stroke rehabilitation therapies.

PLACES AND SPACES

Session Moderator: Christopher Campbell, Community and Environmental Planning
Student Moderator: Shawn Landis, Ceramic Art, Senior

BUILT LANDSCAPES OF THE NORTH DUWAMISH: PHOTOGRAPHING SEATTLE'S CHANGING INDUSTRIAL CORE

OWEN GUMP, Community and Environmental Planning, Senior, MARY GATES SCHOLAR
CHRISTOPHER CAMPBELL, *Community and Environmental Planning*

This project consists of a photographic documentation of the South Downtown/North Duwamish industrial area of Seattle, focusing primarily on the area's vernacular structures and landscapes. Due in part to changing land use patterns and regional economics, much of this area is being altered and re-developed. Through a series of black and white photographs, this project documented and created a record of the area's existing character, as it appeared in 2001-2002. The project also shared this record with students, faculty, and professionals in the fields of environmental design and planning. This was accomplished through two exhibits, one at the American Institute of Architects, Seattle in February, 2002, the other in the UW's College of Architecture and Urban Planning in May, 2002. In addition, a complete set of prints—processed to archival standards—was donated to the Special Collections division of the University of Washington Libraries for inclusion in their permanent collection. Photography for this purpose is not without precedent. While the 20th Century saw an increased use of the medium for commercial purposes and eventual acceptance as a fine art, the use of photographs to document and describe architecture and the built environment has remained constant since the invention of the medium in 1839. This type of photography is best exemplified in the work of the 19th Century Parisian photographers Charles Marville and Eugene Atget, by Bernd and Hilla Becher in post-war Germany, and most recently by the "New Topographics" style popular in 1970s America. The results of these many photographers and projects are extensive records that illustrate the character of man-made structures and landscapes as they appeared at specific points in time. In the same tradition, these photographs of the South Downtown/North Duamish will provide a valuable public record of Seattle's changing industrial landscape, before it inevitably disappears.

LAND ART 2000 AND ONE

SHAWN LANDIS, Ceramic Art, Senior, MARY GATES SCHOLAR
PAUL MARGOLIS, Ceramic Art, Senior
MAREK WIECZOREK, *Art History*
JAMIE WALKER, *Ceramic Art*

In the summer of 2001 two artists spent five weeks traveling around the United States visiting and documenting what remains of the art movement called 'Land Art' or 'Earthworks.' They visited twenty-three of the permanent sculptures that were created in the 60's and 70's. Also visited were many other tourist attractions, war memorials, public art sites, and Native American earthworks that are often confused with the land art movement. The land artists tried to create art that did not simply rest in the landscape but integrated the landscape and made it an essential aspect of the work. The most successful land art sculptures are very isolated from urban life and often existed as the only manmade object in their surrounding landscape; they are tranquil and timeless and often a photograph will never give the work justice. One question that they propose to investigate in their studies is 'what is land art and how is it different than a tourist attraction like Mount Rushmore?' Artistic issues of entropy, rejecting the gallery system, and the idea of art as an experience will also be addressed in the research. As is important in the experience of land art, the journey portion of the road trip will be included in the lecture to reinforce the idea that land art is a unique experiential process.

PLACES AND SPACES

LIBRARY ARCHITECTURE: DEVELOPMENT OF THE TYPE AND MODERN INTERPRETATIONS

NICOLE GUSTINE, Art History, Senior
MEREDITH CLAUSEN, Architectural History

The library, a civic institution dating back for centuries, is no longer simply a repository for books. Today a library's function is increasingly multi-faceted, fulfilling roles such as social meeting point, harbinger of technological advancement, and in some cases, indicator of its benefactor's or community's financial status and aesthetic values. Though library architecture has changed widely from Renaissance style prototypes, through the Beaux Arts traditions of the 19th century and into the steel framed glass skinned structures of today, one constant is that a library's form takes on symbolic meaning as it represents the cultural values of not just its architect but of its end users. Nowhere is this more apparent than in the case of the public library, designed theoretically not for a single client but for a large and diverse community. The challenge to the architect in designing a library that belongs to the community is not only to fulfill a huge number of functional needs (ease of circulation, ample space, and overall comfort) but also to reflect something of the overarching aesthetic ideal of the collective group. The goals of this paper are threefold: 1) to consider the historical development of the library as an architectural type; 2) to examine examples of American libraries in order to decipher the issues and needs that may be specific to library users in the U.S.; and 3) to focus on the conceptual and political problems involved in designing a modern public library by discussing and comparing the proposed new Seattle Public Library designed by Rem Koolhaas in 1999 and the Bibliothèque Nationale de France, Paris, designed by Dominique Perrault in 1992.

PRESERVATION OF MISSION 66 IN THE NATIONAL PARK SERVICE

BARBARA SMITH-STEINER, Landscape Architecture, Senior
GAIL DUBROW, Urban Planning

Fifty years ago, the impact of Mission 66 changed the face of the National Park Service. The National Park Service is now required to assess the National Register eligibility of Mission 66 structures and designed landscapes that are about to be modified. If found eligible, Section 106 compliance review is required prior to contracting for any work. Mission 66 structures, landscapes and developments are based on principles of Modern Architecture. They are generally seen as poorly constructed and visually unappealing, and thus are often under-appreciated in most parks. Many proposed projects for needed improvements also contain an element to make these resources "better looking". These changes could adversely affect a significant structure or landscape. My research has focused on the National Park Mission 66 buildings and landscapes including (1) indentifying the elements that give their visual character, (2) creating an inventory of existing features in the Pacific West Region, and (3) evaluation strategies for meeting park planning and compliance needs.

PROTEIN FUNCTION IN CELL BEHAVIOR

Session Moderator: Stephen Hauschka, Medicine
Student Moderator: Roland Lopez, Biochemistry and Psychology, Senior

ACTIVE CASPASE-8 IS PRESENT IN NORMAL ADULT MOUSE NEURONS

Jo CHOI, Biochemistry, Senior, MARY GATES SCHOLAR
GWENN GARDEN, Neurology

Caspases are a family of proteases involved in the regulation and execution of apoptosis. Caspases are synthesized as inactive pro-enzymes and activated by proteolytic cleavage. Caspase enzyme activity has been observed in synaptosomal preparations and reported to proteolytically modulate AMPA receptors. These studies suggest that beyond their role in apoptosis, caspases may also participate in additional cellular functions within the CNS. Caspase-8 is an upstream regulatory caspase involved in apoptotic signal transduction. To determine if caspase-8 is active in the uninjured CNS, adult mice were sacrificed by fixative perfusion, the brains were embedded in paraffin and 10 μm sections were labeled with an antibody recognizing only the active form of caspase-8. Several specialized neuronal populations and regions of neuropil were strongly labeled by the active caspase-8 antibody. Hippocampal pyramidal neurons all demonstrate active caspase-8 immunoreactivity. Neurons of the dentate gyrus and most cortical neurons did not contain immunoreactivity for active caspase-8. No immunoreactivity was detected when the antibody was preabsorbed on fixed, permeabilized apoptotic SH-SY5Y cells with known caspase-8 enzymatic activity. CNS injury by excitotoxic or ischemic insult did not produce an increase in immunoreactivity for active caspase-8. Surprisingly, these injury models resulted in a reduction of active caspase-8 immunoreactivity. These findings raise the possibility that caspase-8 may play a novel, non-apoptotic role in normal CNS function.

INHIBITION OF CELLULAR PROLIFERATION AND CELL CYCLE ARREST IN PROSTATE CANCER CELLS TREATED WITH CALIFORNIA AVOCADO EXTRACT

LIANA NIKOLAENKO, Biology, Senior at University of California, L.A., WASSERMAN RESEARCH SCHOLAR,
HERBERT HAFIF SCHOLAR

DIANE HARRIS, Center for Human Nutrition, University of California, Los Angeles
JAMES ARTEAGA, Center for Human Nutrition, University of California, Los Angeles

Carotenoids are compounds found in high concentrations in fruits and vegetables and play a central role in the chemopreventive effect of a diet high in fruits and vegetables. Lutein, a carotenoid with well-documented biological effects against prostate cancer *in vitro*, *in vivo*, and in epidemiologic studies, is found in the California avocado in concentrations higher than reported for any other fruit. In this study we evaluate the efficacy of an extract from the California avocado, high in lutein and other carotenoids, in prevention of prostate cancer. METHODS: An ethanol extract was prepared from a seasonal variety of California avocados. Prostate cancer cells PC-3 and LNCaP were incubated for 72 hours with increasing concentrations of extract and effects on cellular proliferation were analyzed by XTT assay. Cell cycle progression was subsequently measured by flow cytometry. RESULTS: Cellular proliferation was reduced in a linear fashion with increasing dose of avocado in PC-3 (0-750 $\mu\text{g}/\text{mL}$ extract) and LNCaP cells (0-50 $\mu\text{g}/\text{mL}$). Cell cycle analysis demonstrated that avocado extract at 250 $\mu\text{g}/\text{mL}$ caused an accumulation of PC-3 cells at G₂/M phase that was not seen in LNCaP cells treated at 50 $\mu\text{g}/\text{mL}$. No significant changes in the proportion of apoptotic cells were seen in either population. CONCLUSION: Avocado extract significantly reduces proliferation of prostate cancer cells *in vitro*, and increases the arrest of PC-3 cells at G₂/M phase. This study demonstrates that an ethanol extract of avocado high in lutein has potent anti-proliferative effects and provides a cellular mechanism for the known chemopreventive properties of a diet high in fruits and vegetables.

PROTEIN FUNCTION IN CELL BEHAVIOR

MITOMYCIN C TREATMENT INDUCES TIMP1 AND MORPHOLOGICAL CHANGES IN HUMAN MICROVASCULAR ENDOTHELIAL CELLS (hMECs)*

MARGARET HAMNER, Neurobiology, Senior
MAY REED, Medicine

*Scholar also presenting in the poster session.

Tissue repair and many other biologic processes require both the proliferation and migration of cells. In order to study migration separately from proliferation, scientists have traditionally used chemical modulators to inhibit proliferation. One such chemical is Mitomycin C (MMC) which reacts with a cell's DNA, inhibiting division. Due to the common use of MMC we examined its effects on the secretion of molecules involved in the migration of hMECs, namely matrix metalloproteinases (MMPs) and their endogenous inhibitors, tissue inhibitors of MMPs (TIMPs). Studies were performed on a 2-dimensional (2D) matrix and in a 3-dimensional (3D) collagen gel. We found hMECs treated with MMC secreted significantly higher amounts of TIMP1. Protein levels measured by western blot analysis showed an induction of 60 % + 15% ($p=0.002$) on the 2D matrix, and 330% + 30% ($p=1E-4$) on the 3D matrix, relative to control. Furthermore, we showed that cells treated with media from MMC treated cells (media with increased amounts of TIMP1), exhibited a more elongated shape and an increased ability to contract a 3D collagen gel. These changes were not accompanied by a significant difference in MMP levels or activity indicating that the inhibition of MMP activity is not the major effect of TIMP1 in these conditions. Taken together these data suggest that an increase in TIMP1, accompanied by a change in cell shape, can alter the migration of hMEC. Of note, we and others have found that hMECs placed in 3D collagen show minimal proliferation in the presence of low serum concentrations; thus, MMC can be eliminated in these types of experiments. In conclusion, cells treated with MMC secrete more TIMP1, particularly in 3D matrices. This increase and its associated change in cell shape to a more elongated phenotype can alter the cell's ability to migrate.

NEUROPEPTIDES AND SOCIAL BEHAVIOR: ARGININE VASOTOCIN LOCALIZATION IN HAPLOCHROMIS BURTONI, A FISH WITH ALTERNATIVE REPRODUCTIVE TACTICS

ABIGAIL SHAW, Human Biology, Senior at Stanford University, HOWARD HUGHES SCHOLAR,
FROHNMAYER PRIZE IN HUMAN BIOLOGY

RUSSELL FERNALD, Psychology and Human Biology, Stanford University

Neuropeptides are known to be important mediators of social behavior among vertebrates. In particular, arginine vasotocin (AVT; the equivalent of vasopressin in mammals), has been implicated in the divergence of reproductive behaviors among species that assume several different reproductive tactics. In the African cichlid fish *Haplochromis burtoni*, males display two distinct and reversible social and reproductive phenotypes. The two states are marked by dramatic changes in appearance and internal physiology as well as in behavioral patterns including social, reproductive and aggressive behaviors. We hypothesize that AVT plays a role in mediating the behavioral and physiological differences observed in these two classes. To address this question, we investigated the localization of cells that express AVT and its receptor within the brain. Fragments of cDNA encoding AVT and its receptor were amplified from *Haplochromis burtoni* using degenerate oligonucleotides. Full-length sequence was obtained using Rapid Amplification of cDNA Ends (RACE). A riboprobe specific to the untranslated regions of each gene was generated for *in situ* hybridization studies to determine which cells (and which brain regions) express the mRNA transcripts for these genes. Neurons producing AVT were found in the parvocellular, magnocellular, and gigantocellular portions of the preoptic area of the hypothalamus, an area of the brain known to be important in reproductive behavior and also directly implicated in controlling reproductive states in these fish. Experiments determining the expression of the AVT receptor are currently underway.

PROTEIN FUNCTION IN CELL BEHAVIOR

NMR STRUCTURAL STUDIES OF Mg^{2+} AND Ca^{2+} BOUND CALMODULIN

SANAZ JANKHAH, Biochemistry, Senior
RACHEL KLEVIT, Biochemistry

Calmodulin is an ubiquitous signal transduction protein that is involved in multiple biological processes. The protein exists in three forms, unbound (apo), Ca^{2+} bound and Mg^{2+} bound. In Dr. Klevit's lab multidimensional nuclear magnetic resonance spectroscopy (NMR) is applied to study three dimensional structure of proteins. The structure of unbound CaM from the yeast, *S. cerevisiae*, (γ CaM) has been solved previously. We know that upon ligand binding the protein undergoes a conformational change to reveal hydrophobic surfaces for interaction with Calmodulin target proteins. We have applied one, two and three-dimensional NMR experiments to assign the backbone of the Mg^{2+} and Ca^{2+} bound γ CaM so far. The evidence from the NMR and dipolar coupling measurements suggests that at resting intracellular condition γ CaM is bound to Mg^{2+} due to the low concentration of Ca^{2+} ; however, this Mg^{2+} binding seems to induce a structural change in the protein that is different from the Ca^{2+} bound form. Our final goal is to study the structural differences between the Mg^{2+} and Ca^{2+} bound γ CaM furthermore in order to have a better understanding of the role of CaM in these two binding forms.

RGD MEDIATED BINDING OF KAPOSI SARCOMA-ASSOCIATED HERPESVIRUS TO CELL SURFACE INTEGRIN RECEPTORS

YELENA RUBINCHIKOVA, Biochemistry, Senior
TIMOTHY ROSE, Pathobiology

My project is to determine the mechanism of infection of Kaposi's sarcoma-associated herpesvirus (KSHV). KSHV is the most recently discovered herpesvirus that is associated with several AIDS-related malignancies, including Kaposi's sarcoma. We have shown that glycoprotein B (gB) of KSHV is an envelope protein involved in binding to host cells. Our lab has identified an RGD motif on KSHV gB that is also found in extracellular matrix proteins that bind cells. The RGD binds to integrin receptors that are present on the cell surface. Cells that bind to RGD spread and show changes in morphology due to alterations in the cytoskeleton. To test if KSHV binds to cells via RGD, we have tested whether the fibrosarcoma cell line HT1080, which has well characterized integrins, can bind to gB. We have shown that HT1080 cells adhere to the RGD motif of gB in a dose-dependent manner, but fail to adhere to the conserved RGE motif. Cell binding is blocked by soluble RGD, but not by RGE peptides, suggesting that RGD binding is specific. Adhesion through integrin receptors induces subsequent phosphorylation of members of the integrin signaling pathway. Focal adhesion kinase (FAK) is the best-characterized kinase known to become phosphorylated. My project was to test whether the adhesion of HT1080 cells to RGD peptides causes increased phosphorylation of FAK. FAK protein was immunoprecipitated from cells plated on either RGD-gB or RGE-gB peptides, and then was analyzed by immunoblotting. I found that FAK was equally phosphorylated in HT1080 cells plated on either peptide. Further experiments are needed to determine if this lack of increased phosphorylation is characteristic of HT1080 cells or if there are further technical problems to be solved. Alternatively, RGD induced signaling may be through a FAK-independent pathway. Defining the mechanism through which KSHV interacts with host cells will have important implications for viral replication and pathogenesis.

PROTEIN FUNCTION IN CELL BEHAVIOR

PROBING SPARC INTERACTION WITH THE EXTRACELLULAR MATRIX

MARIYA SWEETWYNE, Zoology, Senior, HOWARD HUGHES SCHOLAR, SPACE GRANT SCHOLAR,
E. HELENE SAGE, *Vascular Biology and Biological Structure*
ROLF BREKKEN, *Vascular Biology*,

SPARC (secreted protein acidic and rich in cysteine) is a multifunctional glycoprotein that regulates cellular proliferation and the activity of several growth factors as well as modulates cellular interaction with the extracellular matrix (ECM). SPARC expression is largely found in sites of tissue remodeling, such as tissue undergoing development or response to injury. Angiogenesis, the development of new blood vessels from preexisting ones, is an important component of the tissue remodeling process. During angiogenesis, endothelial cells (EC) detach from their substrate, migrate, proliferate and then reattach to the basement membrane. SPARC can modulate the angiogenic process in multiple ways, such as how tightly EC adhere to their substrate, and how angiogenic growth factors stimulate EC. It is known that SPARC binds to several ECM proteins such as collagen type IV and fibril-forming collagen types I, II, III and V. Here we report that SPARC also binds to laminin 1. The localization of SPARC to structural matrix proteins might be critical for the function of SPARC. To aid in the study of SPARC, we have produced a panel of monoclonal antibodies (MAbs) that bind to a number of different epitopes on SPARC. Initial results from an in vitro binding assay demonstrate that four of the MAbs do not block SPARC from binding to either collagen type I or laminin 1, while a commercial MAb, AON-1, does block SPARC from binding to both. We are currently evaluating the effect of additional anti-SPARC MAbs on the interaction of SPARC with ECM proteins. For characterization of SPARC in complex processes, such as angiogenesis, it will be beneficial to have MAbs that block SPARC from interacting with the proteins of the ECM as well as MAbs that can localize SPARC to the ECM. We anticipate that these MAbs will help elucidate how SPARC binds to matrix proteins and therefore increase our understanding of the function of SPARC.

STRUCTURAL MODIFICATION OF THE ELECTRON TRANSPORT INHIBITOR, MYXALAMIDS, IN THE MYXOBACTERIUM STIGMATELLA AURANTIACA PEBS7-1

KWUN WAH WEN, Biochemistry, Senior, MARY GATES SCHOLAR, MCNAIR SCHOLAR
TAIFO MAHMUD, *Chemistry*

The myxalamids (A-D) belong to one of four groups of antibiotics that have been isolated from the myxobacteria *Sigmatella aurantiaca* Sga15 and *Myxococcus xanthus* Mx12. These secondary metabolites are biologically active against yeasts and molds, and are inhibitors of the electron transport in the respiratory chain. Myxalamid B has been demonstrated to block the NADH:ubiquinone oxidoreductase at the site of complex I in beef heart submitochondrial particles. These natural compounds are catalyzed by two very large and complex polyfunctional enzymes, polyketide synthases (PKSs) and non-ribosomal peptide synthetases (NRPSs). The biosynthetic gene cluster of myxalamids has been reported by Müller and co-workers. There has been evidence that the loading domain of the PKSs and the subsequent enzymes responsible for the myxalamid biosynthesis are rather flexible in terms of their substrate-specificity. We manipulated the biosynthetic processes in myxalamid producer using unnatural N-acetylcysteamine (SNAC) derivatives of a number of carboxylic acids to mimic the CoA starter units, which are naturally accepted by the PKSs, to generate novel analogs of myxalamids and study the substrate-specificity of the myxalamid PKS. Feeding experiments with SNAC derivatives revealed that the two major enzyme complexes (PKSs and NRPSs) responsible for myxalamid biosynthesis, to some extent, can accept unnatural substrates. This research approach could be a new tool to search for new potential pharmaceutical natural products.

QUESTIONING AUTHORITIES

Session Moderator: Brian Reed, English

Student Moderator: Roy Chan, Russian Language and Literature and Comparative Literature, Senior

CLOSE ENCOUNTERS OF THE PLAUSIBLE KIND: INVESTIGATING THE PLAUSIBILITY OF IMPLAUSIBLE EVENTS

CHRISTOPHER DESSERT, Psychology, Senior

ELIZABETH LOFTUS, Psychology

JACQUIE PICKRELL, Psychology

Recent studies have shown that people can be led to believe that they experienced events that they have not experienced. Researchers believe that an important element in the creation of these false memories is the role of plausibility. It had been argued that only events that are plausible may be implanted into memory (Pezdek, Finger, & Hodge, 1997). This suggests that memories for highly implausible events are either true memories or nonexistent. However, in 2001, Mazzoni and her colleagues convinced a significant minority of people that they had witnessed a demonic possession. She did this by first, increasing the plausibility of possession and then, measuring subject's belief it had happened to them. Given the influence of religious beliefs attached to this event, we hoped to replicate these results with even less plausible critical events, such as witnessing a UFO or seeing an extraterrestrial. The present study uses current news articles about these events to increase plausibility. One hundred and twenty psychology students at the University of Washington participated in this study in order to earn optimal course credit. Participants completed a Life Events Inventory and a Plausibility Questionnaire. The first assessed the likelihood that target childhood events happened to them; the second measured their belief (plausibility) that target events could happen to anyone. The experiment consisted of three phases, during each of which the two questionnaires were administered: mass testing, the reading of news articles, and a third and final session that included debriefing. Each questionnaire contained our two target events, seeing a UFO and seeing an extraterrestrial. Analysis included determining changes in scores over time. Results will be discussed in terms of malleability of plausibility and the potential for the creation of false memories.

GEORGE WASHINGTON CARVER AND ERNEST EVERETT JUST: RACE, POLITICS, AND POWER IN AMERICAN SCIENCE

MAX HUNTER, History of Science and Comparative History of Ideas, Senior, MARY GATES SCHOLAR,

MCNAIR SCHOLAR, PRESIDENTIAL SCHOLAR

BRUCE HEVLY, History

KARL HUFBAUER, History

George Washington Carver was recognized as an American scientist par excellence. He was compared to Thomas Edison while living; at the end of his life Carver's place of birth was made a national monument. (George Washington and Abraham Lincoln are the only other Americans who share this distinction.) When scrutinizing the actual scientific work produced by the academic, many of Carver's critics, then and now, questioned its historical and scientific significance. This paper examines the political, scientific, and social trends in American science at the turn of the century in relation to Carver and his work in order to make sense of a historical persona of mythological dimensions. It suggests that Carver's work fit the ideological framework of American science and the national scientific agenda at the specific historical moment the scientist inhabited. Moreover, as a personality, Carver fit the persona that white America expected and desired of African-Americans during his era. Carver's standing with Booker T. Washington and American science in mission placed him in a strategic position that captured the social, political, and scientific impetus that propelled him into the national spotlight and the American imagination, despite his critics. This piece also demonstrates that the work of other black scientists, such as Ernest Everett Just, did not receive national recognition as contributions to the advancement of American science, because of a failure to fit into the national scientific agenda in the same manner and for lack of the political and social savvy of Carver.

QUESTIONING AUTHORITIES

GOD SAVE ENGLAND! THE USE OF RELIGIOUS LANGUAGE TO SUPPORT NATIONAL SUPERIORITY IN SPENSER'S "A VIEW OF THE PRESENT STATE OF IRELAND"

MEGAN MATTHEWS, English, Junior
MICHAEL KUCHER, *Interdisciplinary Arts and Sciences*

The belief that one nation, or people, is destined to subjugate citizens of other, inferior states is an idea that helped justify the actions of many colonizing and imperialist nations throughout history. Indeed, after witnessing the violence of the past century, it is often difficult to recall that this conviction appeared long before American settlers eradicated native tribes, or before Europeans discovered that the slave trade was a lucrative business. The history of the relationship between England and Ireland tears across time in a bloody sear; throughout the turbulent centuries, many English scholars wrote extensively on the subject, hoping to elucidate the solution to an apparently inexorable problem. Renowned as the moral champion of Queen Elizabeth, Edmund Spenser entered the discourse by writing *A View of the Present State of Ireland*. Scholars have been frustrated by paltry historical information surrounding the text's purpose and audience; moreover, its assertion of violent solutions to the Irish "problem" appears to contradict Spenser's humanist reputation. However, I believe that a close examination of the work's style and language begins to illuminate Spenser's intentions. I argue that Spenser employs Renaissance and Reformation rhetoric while simultaneously drawing upon Biblical allusion to espouse the image of England as a "godly" nation destined to control the culturally and spiritually inferior Irish people by any means necessary. Spenser's arguments for the suppression of Ireland convey his eagerness to enforce the concept that England is the "elect" state. I believe that this may be the key lesson for contemporary scholars, who appear to be divided wholly regarding the author's intent: Spenser's text is a clear call for English domination over the Irish, a declaration of one nation's superiority over all others, and an unsettling emergence of a mentality that would surface repeatedly in the upcoming centuries.

MIKHAIL KUZMIN: AUTHOR, AESTHETE, GAY ICON?

ROY CHAN, Russian Language and Literature and Comparative Literature, Senior
GALYA DIMENT, *Slavic Language and Literature*

Mikhail Kuzmin (1872-1936) has gained both fame and notoriety as a prominent figure in early 20th century Russian literature and as one of the few gay writers who wrote openly on the subject of same-sex love between men. Although gay critiques of Kuzmin's work did not begin in earnest until the late 1960's among American Slavists, a significant body of gay/queer criticism has developed from that time. This thesis will attempt a queer analysis of a selection of Kuzmin's prose work, employing insights from a variety of contemporary and past philosophers and critics, including Mikhail Bakhtin, Jacques Lacan and present day queer theorists. In examining Kuzmin's work in the context of recent gay/queer criticism, the thesis will also analyze how such critics have repeatedly ignored and/or minimized elements of misogyny, gender anxiety, and the destructive potentialities of desire in Kuzmin's text in order to portray the author and his text as a pre-cursory exemplar of gay/queer identity and liberation. This work will conclude with an examination of the nature of politically oriented literary criticism and the possible negative effects of a critical inquiry whose original purpose is to give aid to a project of emancipation.

QUESTIONING AUTHORITIES

THE POTATO GOBLIN: IRONY AND TABOO IN THE NORTHERN ECUADORIAN HIGHLAND QUECHUA JOKE-NARRATIVE. A CONTRIBUTION TO THE ANTHROPOLOGY OF HUMOR

AVI TUSCHMAN, Anthropological Sciences, Senior at Stanford University, PRESIDENTIAL SCHOLAR,
GIGI PRITZKER SCHOLAR

JAMES FOX, *Anthropological Sciences, Stanford University*

This work examines humorous ironies and their tabooed subject matters in the Ecuadorian Quechua joke-narrative. Much like a fable, this form of oral literature transmits cultural values to the younger generation, however the stories contain highly symbolic and implicitly risqué jokes. While the humorous narratives, which skilled storytellers relate in a poetic style, entertain and educate, they also inform a great deal to the anthropologist for two reasons: (1) Because all humor has an element of irony, one can infer a Quechua-speaking group's expectations and ideas about the world by each irony's violation of these expectations; (2) Since humor concerns subjects tabooed in normal conversation, such as sexuality, inter-ethnic relations, and death, to name a few, this study reveals the expression of one Quechua people's unique cultural anxieties surrounding a group of problematic and absurd topics common to human societies. By synthesizing several twentieth-century theories of humor and taboo, as well as new ideas, this paper endeavors to build a theoretical base and methodological framework for other ethnographers to use in anthropological studies of humor. Special subtopics include: (1) A discussion of universal taboo categories and unique Quechua taboos; (2) a justification for the new Quechua orthography introduced; (3) notes on various levels of translation, poetics, and transcription issues; (4) grammatical structures peculiar to oral literature; (5) explications of allegories and word symbolism; (6) a detailed list of Quechua insults with commentaries on their relation to humor; (7) interviews that contextualize the Quechua joke in relation to generations of Natives and the gaps between them; (8) irony, taboo, and humor in the semantics of Quechua morphology.

ATTITUDES TOWARDS ZIONISM IN SEATTLE'S SEPHARDIC JEWISH COMMUNITY, 1930-1960

MEGHAN PINCH, International Studies and Jewish Studies, Senior, MARY GATES SCHOLAR

SARAH STEIN, *Jewish Studies*

KATHIE FRIEDMAN, *Jewish Studies*

My thesis examines the evolving attitudes towards Zionism and support of Israel in Seattle's Sephardic (Jews who trace their ancestry to Spain prior to 1492) community from the 1930's through the 1960's. How did the Sephardim of Seattle react to Zionism, and what factors in the social landscape of Seattle accounted for these factors? When did Seattle Sephardi reactions to Zionism change? And finally, what factors changed to accommodate changes in Sephardic perception of and involvement in Zionism? I am investigating these questions through interpretation of primary sources such as personal memoirs, synagogue meeting minutes, personal correspondence and individual and group recollections of historical events in interviews. My findings thus far have shown that before World War II, Sephardim in Seattle were largely non-Zionist, and this non-Zionism was fundamentally tied to intra-ethnic tension between Seattle's Sephardic Jewish community and the Ashkenazic (Jews who trace their roots to Central or Eastern Europe) community of Seattle. As Sephardim fought to be seen as a legitimate segment of Seattle's Jewish community, they were forced to come to terms with Zionism and their role in this political movement. Evidence of changing attitudes towards Zionism becomes apparent beginning in the era of the Second World War. World War II and the events surrounding it brought about an unprecedented unity among Seattle's Jewish Communities, and certain aspects of Zionism that had contradicted or marginalized Sephardic identity changed so that Zionism now complemented Sephardic identity. Specifically, relations between Ashkenazim and Sephardim improved considerably because of joint experiences such as the Holocaust, military service, and the establishment of the State of Israel. Consequently, Zionism became a point of unity between Ashkenazim and Sephardim, and Sephardim became more actively supportive of Israel.

RESEARCH METHODS FOR THE WAY THINGS WORK: THE PHYSICAL WORLD

Session Moderator: J. Nathan Kutz, Professor, Applied Mathematics
Student Moderator: Matt Patterson, Applied Computational and Mathematical Science, Senior

BUILDING AN OBJECT ORIENTED DETECTOR DESCRIPTION LANGUAGE FOR THE ATLAS EXPERIMENT AT CERN

JEFFREY GIANIRACUSA, Mathematics and Physics, Junior, MARY GATES SCHOLAR, GOLDWATER SCHOLAR
STEVEN GOLDFARB, Physics, University of Michigan and CERN

The Muon Spectrometer subsystem is one of the largest and most complex components of the ATLAS experiment at CERN. The software for analysis of muon events requires a detailed description of the geometry of all material in the detector so that effects of particles passing through matter can be accounted for. This description must be human readable and easily maintainable since the detector design is still subject to frequent changes. The ATLAS Generic Detector Description (AGDD) language, an XML/C++ based system, can describe geometry, but it is a low level description in terms of geometric primitives and is difficult for a human to read or maintain. For this reason the COMPACT mechanism was added to AGDD so that a high-level description could be written in an object oriented framework. However, only a few simple components of ATLAS have thus far been described using Compact AGDD, and so the development chain has not been fully tested. I have written the description of the Barrel Toroid bending magnets of the Muon Spectrometer. I will describe the motivation and philosophy behind COMPACT AGDD and the benefits of moving to this object oriented system for large experiments such as ATLAS.

DYNAMICS OF COUPLED BOSE-EINSTEIN CONDENSATES

MATT PATTERSON, *Applied Computational and Mathematical Science, Senior, MARY GATES SCHOLAR*
J. NATHAN KUTZ, *Applied Mathematics*
BERNARD DECONINCK, *Mathematics*

Dilute gases of certain alkali metals cooled to extremely low temperatures have been made to undergo the process of Bose-Einstein condensation. Researchers at the University of Colorado at Boulder and M.I.T. shared the 2001 Nobel prize for physics for creation of Bose-Einstein condensates (BECs). This phenomenon plays a part in both superconductivity and superfluidity. BECs have been used to slow light down to the speed of a strong bicyclist, and may have applications in optical computing. A BEC must be stable if it is to be observed. A stable BEC is one that persists in time, and is not susceptible to perturbation. My research has focused on numerically determining the dynamics, and most importantly the stability, of two coupled condensates trapped in a one dimensional potential. The condensates interact with each other, the potential, and with themselves. For stable pairs of condensates, all these interactions must balance to maintain the integrity of the condensates. Thus far over 400 numerical simulations have been done. We have found that certain potentials tend to aid stability, whereas others are generally destabilizing. We have also found very interesting differences in dynamics between condensates trapped in small spaces and condensates trapped in larger spaces. These results lead to new predictions concerning the dynamics and stability of multi-species BECs in sinusoidal confinement.

RESEARCH METHODS FOR THE WAY THINGS WORK

INVESTIGATING SURFACE FEATURES OF AMORPHOUS SOLID WATER USING ATOMIC FORCE MICROSCOPY

BRIAN LONG, Physics, Senior, MARY GATES SCHOLAR

SAM FAIN, Physics

Atomic Force Microscopy (AFM) is used to investigate nanometer-scale clusters of Amorphous Solid Water (ASW) deposited on various substrates. ASW is a disordered phase of water formed when water vapor is deposited on a substrate at low temperatures. ASW crystallizes as temperature increases and when ASW is deposited on some substrates, cluster formation is apparently coincident with this phase transition. AFM images of cluster formation are analyzed in an effort to understand the mechanism producing this change in surface morphology.

PERIODIC SPACE-TIME DYNAMICS OF BOSE-EINSTEIN CONDENSATES TRAPPED IN STANDING WAVE POTENTIALS

DUTCH MEYER, Computer Science and Mathematics, Senior

J. NATHAN KUTZ, Applied Mathematics

Recent experiments on dilute-gas Bose-Einstein condensates (BECs) have generated great interest in macroscopic quantum phenomena in both the theoretical and experimental physics community. Bose-Einstein condensates are a new form of matter for which all atoms collapse to the same quantum mechanical state. Such BECs are experimentally realized when certain gases are super-cooled to micro Kelvin temperatures and trapped in electromagnetic fields. Recently, there has been much interest in sinusoidal confinement of repulsive BECs using standing light waves. Such BECs have been used to study phase coherence of atoms and matter-wave diffraction. They have also been predicted to apply to quantum logic, matter-wave transport, and matter-wave gratings. We consider the space-time dynamics and stability of BECs trapped in standing light waves. A mean-field description for the macroscopic BEC wave function is given by the nonlinear Schrodinger equation. Numerical simulations suggest that the dynamics can be captured with an appropriate selection of the wavefunction form. This ansatz can be used to minimize the energy associated with the governing equations and results in simplified behavior for the condensate amplitude and phase oscillations. The isolation of the amplitude and phase dynamics allows for a complete description of the underlying wave behavior. This approach allows for a prediction of the characteristic behavior which can be exhibited in experimental settings for the Bose-Einstein condensates. Of particular importance are the predictions concerning the nonlinear frequency and amplitude changes as functions of the standing wave strength and condensate population.

RESEARCH METHODS FOR THE WAY THINGS WORK

PULSE DYNAMICS IN LASERS

JENNIFER O'NEIL, Applied Mathematical and Computational Science and Biological and Life Sciences, Senior
J. NATHAN KUTZ, *Applied Mathematics*

Compact sources of optical pulses near telecommunication wavelengths are key enabling technologies for high speed fiber optic communication systems and interconnection networks. The generation of stable pulses is accomplished within a laser cavity, a process known as modelocking. In a simple pulse modelocking device, a modelocking element within the fiber laser cavity preferentially attenuates weaker intensity portions of individual pulses. This attenuation is compensated by the gain medium which acts to preserve the total cavity energy. Initially, shaping occurs since the peak of a pulse experiences a higher net gain per round trip than its lower intensity wings. This narrowing (compression) of a propagating pulse is eventually limited by the gain bandwidth of the amplifying medium. The primary focus of this research is the development of an analytic model describing active modelocking. Active modelocking is achieved by periodically modulating the cavity gain and can be modeled by a nonlinear wave equation. This new model is proposed for the active modulation component of a modelocked laser cavity. By using Jacobi elliptic functions to capture the periodic forcing to the cavity, we are able to construct exact solutions representing a modelocked pulse train. Two families of pulse train solutions are generated: one in which neighboring pulses are in-phase, and a second in which neighboring pulses are out-of-phase. We show that only out-of-phase solutions allow for stable modelocked pulse trains. Further, pulse-to-pulse interactions can generate instabilities that destroy the pulse train altogether or lead to phenomena known as Q-switching. This Q-switching has been observed in experiments, but has eluded analytic description. However, this model is able to capture this behavior and allows for an analytic description of this particular kind of laser instability. The model predicts the operating regimes of the laser and so can be applied directly to the experimental situation.

SURVIVAL OF THE FITTEST VS. THE FLATTEST

JIALAN WANG, California Institute of Technology
CLAUS WILKE, *California Institute of Technology*
CHRIS ADAMI, *California Institute of Technology*

The Digital Life Laboratory at Caltech investigates the evolutionary processes of living systems through digital media, based on the principle that the behavior of digital organisms (self-replicating computer programs) in artificial environments can yield important insights to the biological realm. Here, we present evidence that the ability of a strain of digital organisms to survive is related both to the organisms' neutrality (the probability that a single mutation will not affect the replication rate of an organism) and their replication rate. We placed complex, well-adapted digital organisms into environments with either low or high mutation rates, which respectively discouraged or encouraged the development of neutrality without significantly changing overall genetic structure. We then put pairs of the resulting organisms into environments with varying mutation rates and recorded the relative abundances of their two lineages. Our experiments showed that in a competition in an environment with a high mutation rate, an organism with higher neutrality would dominate over an organism with low neutrality and higher replication rate. This result is significant in demonstrating that true fitness encompasses more than just replication rate.

SENSORY PERCEPTION AND RESPONSE IN PLANT AND ANIMAL CELLS

Session Moderator: Elizabeth Van Volkenburgh, Botany
Student Moderator: Holly Atkinson, Cellular and Molecular Biology, Senior

ANODE-BREAK EXCITATION IN CELLS OF THE SNAIL SUB-ESOPHAGEAL GANGLIA

KATHERINE BLIZINSKY, Neurobiology and Philosophy, Junior
BLAKE ACOHIDO, Neurobiology, Senior
BILL MOODY, Zoology
JOY SEBE, Neurobiology and Behavior

We all know action potentials can occur with sufficient depolarization of the neuronal membrane. Increase in membrane voltage opens sodium channels to begin the process of action potential propagation. What about action potentials resulting from hyperpolarization of the neuronal cell? Directly after periods of hyperpolarization from rest, neurons may fire one or more times. What is the mechanism behind this kind of firing? Cessation of neuron membrane hyperpolarization can induce action potential generation, due to the increased opening of sodium channel inactivation gates. When the membrane is repolarized to rest, spontaneous opening of sodium channel activation gates cause a rapid influx of sodium ions, resulting in one or a series of action potentials. The number of spikes and duration of these bursts vary logarithmically and exponentially to the length of inhibitory hyperpolarization, respectively. What are the parameters limiting the number of post-inhibitory spikes? And what is the biological significance of this mechanism? Using de-sheathed nerve ring preparations of the snail sub-esophageal ganglia and microelectrode recording, we were able to analyze this phenomenon of post-inhibitory spike generation known as 'Anode-Break' excitation.

EXPRESSION OF OLFACTORY RECEPTOR CONSTRUCTS IN HETEROLOGOUS CELLS

SABRINA ANDERSEN, Biology, Senior
BARBARA TRASK, Molecular Biotechnology
MICHAEL SHLADOR, Molecular Biotechnology

The sense of smell is the ability to detect and discriminate volatile molecules (odorants) in the environment. When odorants enter the nose, they bind to olfactory receptors found in the outer membranes of olfactory neurons. Individual olfactory neurons express only a single type of olfactory receptor. Each type of receptor binds a specific set of odorants, and each odorant may bind to multiple types of receptors. The overlapping binding specificities permit each odorant to trigger a distinctive combination of neuronal signals to the brain, enabling its discrimination. Key to understanding this complex system is determining which odorants bind to which receptors. Determining the binding specificities has been problematic since neurons are difficult to culture and assay, and whole animal studies are complicated and costly. A system in which the olfactory receptors could be expressed in easily cultured, easily assayed non-neuronal cell lines would be extremely useful. Unfortunately, most olfactory receptors do not express functionally in heterologous cells. The receptors become trapped within the endoplasmic reticulum of the cell and do not traffick to the cell membrane. Based on previous research, we hypothesize that the C-terminal tails of the receptors may play a role in this ER ensnarement. To test this, I will be transfecting a heterologous cell line with chimeric and truncated olfactory receptors and assaying for their presence at the cell membranes. The chimeras will be fusions between olfactory receptors and rhodopsin, a related receptor that easily trafficks to the membranes of heterologous cells. I am currently in the process of making these constructs.

SENSORY PERCEPTIONS AND RESPONSE IN PLANT AND ANIMAL CELLS

LIGHT AND HORMONE MEDIATED PHYSIOLOGICAL RESPONSES OF CORN PROTOPLASTS

ANGELA JACOBS, Biochemistry, Senior
ELIZABETH VAN VOLKENBURGH, Botany

For a long time, scientists have tried to determine how plant growth is regulated. Physiological observations have been recorded and studied at the organismal level of the plant, but what are the cellular mechanisms controlling these changes? In this research, corn hybrids have been selected as the model system for manipulation and experimentation of the whole plant versus isolated plant cell preparations called protoplasts. Specifically, the experiments assess the correlations between the physiological changes of second leaf sheath tissue and the responses of protoplasts isolated from the same tissue. Protoplasts are the control centers of plant growth regulation. They monitor the environmental conditions of the plant and respond by inhibition or expression of growth. It is known that plant hormones, various lighting qualities, and nutrient ion concentrations affect plant growth. It has been shown that auxin (NAA), a plant hormone, and light treatments, such as etiolation (plants grown in the dark), high or low ratios of red light (R) to far-red light (FR), blue (B) or white (W), all have varying effects on the growth of second leaf sheath tissue. Furthermore, changing the extracellular (outside the cell) ion concentrations with or without hormone or light treatments also affects plant growth. Do isolated protoplasts show parallel physiological responses, and if so what implications do these results have on the current ideas about plant growth?

THEORETICAL STRUCTURES FOR THE GECKO VISUAL PIGMENTS P467 AND P521

HOLLY ATKINSON, Cellular and Molecular Biology, Senior, HOWARD HUGHES SCHOLAR
TOM EBREY, Botany and Zoology
BILL PARSON, Biochemistry

Visual pigments are membrane-bound receptor proteins with chromophores that isomerize upon absorption of a photon, initiating the visual signalling cascade. Rhodopsin is the archetypical scotopic (black and white) vision effector found in human retinas as well as in most other vertebrate eyes. Gecko pigments P467 and P521, named for the maxima of their absorption spectra, are members of the RH2 ("Rhodopsin-like opsins") and M/LWS ("Medium/Long Wave Sensitive opsins") visual pigment families. The M/LWS family is comprised of cone-type pigments that provide photopic (color) vision. At present there are no empirically-determined structures for P467 and P521. In order to generate an approximation of the tertiary structure of the two gecko pigments, their amino acid sequences were threaded via the Swiss-Model server onto the backbone of the empirically-determined crystal structure of bovine rhodopsin, a member of the RH1 ("Classical rhodopsin") family. The resulting theoretical structures were modified to include a bound chloride ion between Glu181 and Lys184 of P521, along with other characteristic elements. The structures were then analyzed and minimized with Enzymix, a molecular dynamics program, to find the most energetically-favorable conformations for the structures. Our theoretical approximations can tell us much about how evolutionary divergences in the amino acid sequences of these related genes translate into structural differences in the cognate proteins. This information will then contribute to the identification of the key structural properties of visual pigments.

SENSORY PERCEPTIONS AND RESPONSE IN PLANT AND ANIMAL CELLS

WOUND-INDUCED ELECTRICAL SIGNALING IN SUNFLOWERS (*HELIANTHUS ANNUUS*)

NICHOLAS STEPHENS, Cellular Biology and Botany, Junior, MARY GATES SCHOLAR

RAINER STAHLBERG, Botany

ELIZABETH VAN VOLKENBURGH, Botany

Sunflower (*Helianthus annuus*) plants, when subjected to their own leaf extract both the hypocotyl and epicotyl, are found to propagate an electrical signal up along the stem in a similar manner previously described in tomatoes. The unknown compound (or compounds), presumably released from the damaged cells during wounding, causes a systemic depolarization and re-polarization in the intact plant cells and has a molecular size of under 3 kD. We are seeking to understand the properties of this signal in addition to isolating and identifying the component responsible for it. Furthermore we wish to understand the downstream effects of this phenomenon and how an internal communication system proves to be beneficial to sunflowers. Our lab is currently characterizing the relationship between propagation of the signal and transpiration, photosynthesis and ion-channel activity. Seedlings grown in the greenhouse are moved to controlled lab bench conditions and attached to surface-potential electrodes. The magnitude of the propagating signal, induced by exposure to standardized aliquots of leaf extract, will be related to stomatal activity, changes in photosynthesis, growth effects and even differences in development. Seeds of several closely related species in the *Helianthus* genus are also being sown at this time in order to determine the universality of the signaling compound and when it might have evolved.

TEACHING, LEARNING, AND THE ROLE OF EDUCATION

Session Moderator: Catharine Beyer, Educational Assessment
Student Moderator: Amy Lu, Art and Interdisciplinary Visual Arts, Senior

FINDINGS FROM THE UW STUDY OF UNDERGRADUATE LEARNING

WENDY HUYNH, Sociology, Senior
CATHARINE BEYER, Educational Assessment
ANDREW FISHER, Educational Assessment

The University of Washington's Study of Undergraduate Learning (UW SOUL) makes use of interviews, portfolios, students' reflective essays, web-based surveys, open-ended email questions, and academic records in order to discover what undergraduates learn and how they learn it in six areas: writing, problem solving/critical thinking, quantitative reasoning, understanding and appreciating diversity, information literacy, and personal growth. The study is tracking about 300 students from their enrollment in 1999 to their graduations. Its aim is to help the institution understand and improve student learning. The question my research analyzes is whether or not students felt they accomplished the goals they had set out for themselves in their first year at the UW and what contributed to their success or failure. Our results showed that 58 percent of the students said that they accomplished their goals, while 31 percent said they accomplished some goals, 10 percent said they did not accomplish their goals and one percent said they did not have any goals. Most of those students reported accomplishing academic goals; some also reported accomplishing personal and social goals such as becoming independent and wanting to fit in. Finally, students were able to identify why they had or had not attained their goals. They attributed both success and failure to their own efforts. This research shows that many students are determined to set high goals, and they realize what they need to focus upon to attain their goals. These findings are consistent with other UW SOUL findings about the first-year experience. They suggest that the UW community might need to make resources that support students' success more apparent to first-year students.

INTERDISCIPLINARITY IN THE ACADEMIC REALM: UNDERSTANDING THE FUNCTION AND POSITION OF THE INTERDISCIPLINARY COURSE

BRIONY NGUYEN, Comparative Literature, Senior, MARY GATES SCHOLAR
GARY HANDWERK, Comparative Literature and English

The structure of the American educational system is predicated on the idea of disciplinarity. According to a recent publication by higher education professor Lisa Lattuca, "[o]ur colleges and universities, and to a lesser extent our elementary and secondary schools, teach us by word and deed that knowledge is divided into academic disciplines" (1). In the past thirty years, however, interdisciplinary methods of scholarship have become increasingly common on college and university campuses (Lattuca 18). Yet there has been little in-depth research done on actual interdisciplinary courses being taught at this level. This research project is designed to determine how an interdisciplinary course functions by examining and comparing the ways in which students from different disciplines learn in such a course and by investigating the extent to which a student's academic background informs his/her acquisition and application of knowledge. The first stage of this study was conducted within the context of a new course on Literature and the Environment taught during Winter Quarter 2002. By focusing on the ways in which environmental issues are represented in literature, this course asked students to think across disciplinary boundaries. In order to ascertain the learning processes of students in the course, I worked with a sample group of students from different majors whom I asked to participate in interviews, submit papers for review, and complete weekly questionnaires about the course. I also interviewed the professor about his teaching objectives as well as had the class respond to short surveys about the course throughout the quarter. Through analysis of this data, I will provide a comprehensive explication of the internal operation of an interdisciplinary course that will contribute to current understanding of interdisciplinary courses, help improve interdisciplinary courses taught in the future, and offer insight into the role of interdisciplinarity in the academic world today.

TEACHING, LEARNING, AND THE ROLE OF EDUCATION

LIVING CONSENSUS

NATHAN BORGFORD-PARNELL, Community and Environmental Planning and Political Science, Senior
CHRISTOPHER CAMPBELL, *Community and Environmental Planning*

My research is designed to look broadly into the process of reaching consensus and voting with consensus in a number of different academic and business fields. I am also looking more specifically at the particular breed of consensus practiced within the department of Community and Environmental Planning. CEP presents a very special situation for consensus based governance because it is a student run major, which is dedicated to using consensus as a community development tool as well as a voting practice. I am looking at the CEP to identify where it has succeeded and where it has floundered in this process. I will use all of the information I have gathered to produce a document that will hopefully serve as a handbook for groups looking to implement consensus in their governing process.

STUDENTS' VOICES: FINDINGS FROM THE UNIVERSITY OF WASHINGTON'S STUDY OF UNDERGRADUATE LEARNING

AMY LU, Art and Interdisciplinary Visual Arts, Senior, MARY GATES SCHOLAR
CATHARINE BEYER, *Educational Assessment*
ANDREW FISHER, *Educational Assessment*

The University of Washington's Study of Undergraduate Learning (UW SOUL) makes use of interviews, portfolios, students' reflective essays, web-based surveys, open-ended email questions, and academic records in order to discover what undergraduates learn and how they learn it in six areas: writing, problem solving/critical thinking, quantitative reasoning, understanding and appreciating diversity, information literacy, and personal growth. The study is tracking about 300 students from their enrollment in 1999 to their graduations. Its aim is to help the institution understand and improve student learning. The question that my research addresses falls in the area of personal growth. Using an inductive process to generate categories, I analyzed students' email responses to two questions. The first question addressed whether or not students changed in their previous two years at the UW. The second question asked if the UW played any role in the changes mentioned. Findings showed that students improved their abilities to focus on their education and career goals, experienced higher levels of confidence in different areas of their lives, and felt that they had become more mature in relation to academics and personal choices. In addition, students also frequently identified specific character changes over their two years at the UW. Many students attributed these changes to the UW, while others did not. This research shows that in their first two years at the UW, students gain strengths to help them through their next two years in school or in careers. In addition, it names some of the ways UW is succeeding in its undergraduate education program. Finally, the research raises questions about how the development of focus, confidence, and maturity are related.

TEACHING, LEARNING, AND THE ROLE OF EDUCATION

STUDENTS' VOICES: FINDINGS FROM THE UNIVERSITY OF WASHINGTON'S STUDY OF UNDERGRADUATE LEARNING

OLUWATOPE FASHOLA, Sociology and American Ethnic Studies, Junior
CATHARINE BEYER, Educational Assessment
ANDREW FISHER, Educational Assessment

The University of Washington's Study of Undergraduate Learning (UW SOUL) makes use of interviews, portfolios, students' reflective essays, web-based surveys, open-ended email questions, and academic records in order to discover what undergraduates learn and how they learn it in six areas: writing, problem solving/critical thinking, quantitative reasoning, understanding and appreciating diversity, information literacy, and personal growth. The study is tracking about 300 students from their enrollment in 1999 to their graduations. Its aim is to help the institution understand and improve student learning. The question that my research addresses falls into the area of understanding and appreciating diversity. Using an inductive process to generate categories, I analyzed students' interview responses to a question about whether their attitudes about diversity had changed since they entered the UW. A little more than two thirds said that their attitudes had changed. About a third--or 32 percent--said that their attitudes toward diversity had not changed. Students reported changes in their awareness of variations in cultural experiences and norms. They also became aware of the ways minorities are stereotyped and denied the same opportunities and treatment that members of the dominant culture enjoy. Students also said that their attitude changes included reflecting on their own lives in order to better understand themselves and the struggles of others. In addition, many students reported that their changes in attitude were influenced by experiences away from UW. Other students reported attitude changes due to UW connections, and discussions with people who experienced living in different cultures or who had different viewpoints. These findings are significant because they show that the UW is directly having a positive impact on students' attitudes about diversity.

INFORMING A COMMUNITY: EVALUATING AN OPPORTUNISTIC DISPLAY

DAVID GASCA, Informatics, Senior
DEBORAH FRISBIE, Informatics, Senior
LAN ZHANG, Informatics, Senior
JEREMY CHEUNG, Informatics, Senior
JENNAFER NGUYEN, Informatics, Junior
HARRY BRUCE, Informatics

This research evaluates the impact of a large-sized display of community information in the UW's Department of Computer Science and Engineering on that department's faculty, staff, and students. This is being done with particular respect to time management, participation in departmental events, and community awareness. In order to gather information from the entire community in the CSE department, our team integrated several research gathering techniques. A survey was chosen in order to get information from the entire department and set a baseline prior to the implementation of the display. Interviews and a focus group were conducted to gather the opinions of community members while the display is running. Additionally, unobtrusive observations are conducted on those passing by the display. Web hit counts are being collected on departmental websites related to the display in order to compare whether there has been any influence on the number of web hits since the display was turned on. To this point, the survey and the focus group have been completed and the project is in the final stages of collecting data from the informal interviews and unobtrusive observations. The preliminary findings suggest that the display is well received in the community but is under utilized at this point. Results show the display has facilitated participation in departmental events. It has been suggested that the current location of the display is problematic, but for the CSE department, it will be resolved in their new location. If this type of display is adopted by other departments in the future, location will be a key factor.

TEACHING, LEARNING, AND THE ROLE OF EDUCATION

THE IDEA OF COMMUNITY THROUGH 9-11-01

HEATHER ANDERSON Community and Environmental Planning, Senior
MELINDA BARLOW, Community and Environmental Planning, Junior
AMALIA GONZALEZ-KAHN, Community and Environmental Planning, Senior
MICHAEL HELLAND, Community and Environmental Planning, Junior
SAMANTHA UPDEGRAVE, Community and Environmental Planning, Junior
CHRISTOPHER CAMPBELL, *Community and Environmental Planning*

The events of September 11th, 2002 greatly changed the way many Americans perceive their communities and the relationships and responsibilities of those communities to the rest of the world. The students of CEP 301A, "The Idea of Community," could not ignore this fact when given the opportunity by professor Christopher Campbell to leave behind his original syllabus and to create a new syllabus in response to these events. We accepted this opportunity, using it to research seven components of communities, including: The Definition of Community, Civil Society, Community Identity, Representations of Community, "The Other," Community in a Global Context, The Responsibilities of a Community. Although the goal of the course was to reach an understanding of the multitude of responses that communities had in the face of 9-11-01, in the process of reaching that understanding we created a course. In the creating of the course, we created a syllabus, researched possible course material, compiled a course reader, and selected writing prompts and projects. What resulted was a balance of readings that examined a variety of responses and assignments that explored our individual participation in and perceptions of community. The final class project, a course webpage, describes the process of creating this course and outlines the results of our work. We hope that these results can be used as guide to help others in forming courses to address other events or issues of importance. We completed research in two major areas. The first was to research what elements constitute a good course. For example: what information does a successful syllabus contain, which readings would succinctly and effectively display the course's theme, what type of writing prompts and projects aid in the creation of quality workmanship, and how to facilitate class discussions which examine the readings as well as draw upon the students past academic experiences. The second step of research was to examine what available readings pertained to the event and the affected communities. This research was considerably more difficult due to the fact that there was limited analysis of the events available. However, the lack of information directly pertaining to the event allowed us, as researchers, to examine a greater range of works and draw original and unique comparisons between past events and the events of 9-11-01. The creation of a course is certainly not a new experience. What was new in this case was that the students held the responsibility for creating the course.

TECHNOLOGY AND CULTURAL TRANSFORMATION

Session Moderator: Eve Riskin, Electrical Engineering
Student Moderator: Eddy Ferre, Electrical Engineering, Senior

A NEURAL NETWORK DESIGN FOR SPEECH RECOGNITION

CHRIS BAKER, Computer Science, Junior
RAJESH RAO, Computer Science and Engineering

We will design a neural network model that builds on current work in the field. Our design goals include a producing a better model of biological systems that will yield improved computational results. We hope to model the spatio-temporal learning of biological systems; therefore we choose to apply our design to a problem that is time dependent—the problem of recognizing distinct speech sounds. Recent work shows that recurrent networks, where neurons can provide feedback to other neurons and themselves, have a much greater capability for temporal learning. Work has been done to develop a recurrent model called infinite impulse response (IIR) networks, where the current output depends on both previous inputs and outputs, which also have greater computational power. Work in biology has shown that the simplification made in computer science that connections between individual neurons in a network always have the same conductance is false. Biologists have observed instead a dynamic system in the brain, where connections between neurons vary with time. Work in linguistics has shown that language acquisition is largely unsupervised. Hence, we will present a locally and globally recurrent IIR network that learns spatio-temporal patterns dynamically, in an unsupervised manner. The initial work will include a new computational model designed to learn complex spatio-temporal patterns efficiently. We will reference work in the area of feature learning and competitive learning that will guide our design of the unsupervised model. The model will be simulated mathematically and computationally and runtime data will be compiled and analyzed for correctness and efficiency.

DISTANCE LEARNING TOOLS FOR DISCRETE AND CONTINUOUS TIME LINEAR SYSTEM (EE 235 - EE 341)

EDDY FERRE, Electrical Engineering, Senior, MARY GATES SCHOLAR
EVE RISKIN, Electrical Engineering

Our project (FIPSE) consists of the development of a two-year Electrical Engineering curriculum for distance learning. My first task was to develop software applications allowing a visual understanding of EE 235 and EE 341 Linear System concepts using Macromedia Flash. Then, after learning how to create animation, including sound and buttons, my mission was to design a few examples served as template documents. Working in cooperation with Professor Riskin and Wai Shan Lau, we have developed a web page of lectures for EE 235, which includes Flash animated examples and demonstrations. Currently, on-campus students can access this new material. In addition, positive feedback is encouraging the development of other EE courses based on the model we developed. This quarter my role consists of the implementation of interactive homework exercises and discrete time demonstrations, in collaboration with EDGE. The goal is to enable a reliable control of the knowledge acquired by the students.

TECHNOLOGY AND CULTURAL TRANSFORMATION

INTERROGATIVE PROGRAMMING: QUESTIONS ABOUT COMPUTER PROGRAMMING FOR NOVICES

ALEX QUINN, Computer Science, Senior
STEVEN TANIMOTO, Computer Science and Engineering

Imagine a computer that could program itself. What would that mean? We explore a new method of programming specifically designed for people with no programming experience. Interrogative programming tries to deduce what you want your program to do by asking a series of closed-answer questions. This method can be easily adapted for creating many kinds of programs. We discuss the benefits, capabilities and limitations of interrogative programming along with the results of a recent usability study with our prototype.

MUSICAL APPLICATIONS OF OUR EAR'S IMPERFECTIONS

CASEY WESCOTT, Music, Junior
MATTHEW ZUMWALT, 2001 UW Graduate
VLADIMIR CHALOUPKA, Physics and Music

Our ears are stunningly complex organs. Modern science still fails to fully understand the intricate mechanics that allow our ears to process audio information. These natural wonders are not perfect, though. They do introduce some amount of distortion to perceived sounds. An example of these distortions are difference tones, tones that do not exist in the air but are perceived due to nonlinearity of our inner ears. Difference tones occur when two tones reach the ear simultaneously. If the two tones are of sufficient amplitude and less than one octave apart, a third tone with a frequency equal to the difference of the two real tones is heard. This is just one in a number of such distortion derived tones, which are often referred to collectively as difference tones. Our research sought to inform assessment of the musical significance of difference tones by looking at conditions affecting humans' perception of them. Our research shows that tones caused by distortion in our ears have many implications affecting what we hear and how we hear, as well as our musical decision making. In our presentation we will offer a theory of how difference tones have had a hand in shaping the western tuning and tonal system as well as an insight into our conception of consonance and dissonance. Additionally, we will submit an example of how difference tones can be used with the aid of a computer to help musicians play 'in tune'. Our work involved both textual research and experiments which we have conducted using SuperCollider, a real-time sound generator and processor.

REDUCING THE COST OF FILE SYSTEM DAMAGE

SHIRLEY GAW, Computer Engineering, Senior
JOHN ZAHORJAN, Computer Science and Engineering

Some rogue computer programs, such as viruses, only seek to damage computer files. Backup systems reduce the cost of this damage by periodically copying files from a computer to another area for storage. Then, the execution of a rogue program can be undone at a later date. All files, even undamaged files, would be replaced with backup versions. We have explored a finer grained approach, providing features to minimize the impact on undamaged files. This talk will explain the technical challenges involved in this approach. We will also speculate on how effective this approach would be in practice using preliminary measurements from a Windows system.

TECHNOLOGY AND CULTURAL TRANSFORMATION

SEE SPOT RUN: TEACHING NEURAL NETWORKS TO LEARN BY IMITATION

THOMAS CARLSON, Computer Science, Mathematics, and English, Senior, MARY GATES SCHOLAR
RAJESH RAO, *Computer Science*

The subject of machine learning has blown open the field of Artificial Intelligence in the last twenty years, but still there have been some problems that traditional learning systems have had great difficulty solving with any success. Frustratingly, these are often problems which humans solve off-handedly, unconsciously, and early in life, characterized by imitating behavior of some other agent (such as a parent or older sibling). Notorious examples include speech and natural language processing, and coordinated motor skills such as walking and running, although even adult humans will learn by imitation skills such as driving. We investigate the structure of imitation learning from a problem-oriented perspective, and how Artificial Neural Networks (ANNs) might learn by imitation. Specifically, just as Barto & Sutton formulated the problem of reinforcement learning, we formulate a formal model of imitation learning (and the requirements for an imitation learning problem to be posed), and investigate its formal properties. Then we examine several of the many currently-proposed computational models for ANNs (e.g. signal, linear, and sigmoid units, feed-forward and recurrent topologies, integrative and spiking neurons) and their potential for displaying imitation learning behavior, making steps towards both the development of ANN algorithms for imitation learning and potentially a theoretical discussion of the limits of ANN learning.

THE ARTS AND HUMAN HISTORY

Session Moderator: Scott Noegel, Near Eastern Studies
Student Moderator: Jamie Franklin, Art History, Junior

AFRICAN DANCE IN SENEGAL AND THE GAMBIA

FAWNIA CHAUVAUX, Dance, Senior
ROB KITSOS, Dance

West African music and dance reflect the integration of society through expressing oral histories, religious beliefs, family values, gender roles, rites of passage and connections between the physical and spiritual worlds. The importance of community involvement in music and dance became apparent when I traveled to Africa to observe and participate in the music, song, and dance. During my research abroad, I learned traditional rhythms and dances of the *Wolof* in Senegal and the *Mandinka* in Gambia. I continue to research, document and share my findings on the historical significance and meanings of these cultural traditions. I have found that there is very little documentation of these art forms. In Senegal and Gambia, the musicians, singers, and dancers belong to a social cast known as *griots*. In the past, the *griot* has been described as a historian, advisor, spokesperson, diplomat, interpreter/translator, mediator, witness, praise-singer, exhorter, warrior, musician, composer, teacher, and master or participant of ceremonies. Through each stage of existence, ceremonies are held to appeal to the Divine Creator for protection, fertility, success, and acceptance into the spirit world. At these ceremonies, African music and dance become an expression and medium for connection between the physical and the spiritual. Since my experience, I have been inspired to create an arts school in the Gambia that encourages international exchange and collaboration. My hope is that my research and plan for an arts school will encourage the growth and development for these artists to pass on their traditions and share their talents on a global level.

AGAIN I TELL MY STORY: DOCUMENTARY FILMMAKING AND INDIGENOUS RESEARCH METHODOLOGIES

JENNIFER SCHMITT, Women Studies, Senior
KAPI'OLANI LEE, American Ethnic Studies and Art, Senior
LUANA ROSS, Women Studies
DAN HART, American Indian Studies

A film in post-production through the Native Voices Program in American Indian Studies, "Ha'ina Mai Ka Puana," depicts the emergence of a Pacific Islander student movement at the University of Washington. It is an historical account of an effort at ethnic self-definition by indigenous peoples. "Ha'ina Mai Ka Puana" documents the first two years of the Pacific Islander Student Commission, the first minority commission established for Pacific Islander students in the country. Yet, despite these accomplishments, Pacific Islander students continue to face appropriation of native culture by nonindigenous student groups and educational discrimination from the university. While the film illustrates the students' many achievements, it also acknowledges their ongoing struggles for cultural survival in the face of intense insitutional racism. The intent of this research is to demonstrate the relationship between documentary film genre and indigenous research agendas. While documentary conventions have traditionally served the devastating interests of colonial "science," our work realizes film's potential as an oral and visual medium for reinforcing native ways of knowing. Furthermore, our film deconstructs the "scientific discovery" of indigenous peoples. In fact, it is we as indigenous filmmakers who are discovering science's potential for cultural preservation and survival (Tuhiwai Smith, "Decolonizing Methodologies"). Documentary thus evolves through native peoples' participation in knowledge production; our work challenges the conventions, aesthetics and notions of authorship that has historically accompanied this discipline.

THE ARTS AND HUMAN HISTORY

FEMINISM AND THE BEAUTY PAGEANT IN AMERICAN FILM

KATHRYN OFFER, Women Studies and Sociology, Senior, MARY GATES SCHOLAR
SUSAN JEFFORDS, *English and Women Studies*

Feminism and the beauty pageant have never been comfortable bedfellows. Ever since the 1968 Miss America pageant protest at which organizer Robin Moore referred to Miss America as, "the degrading mindless-boob-girlie symbol" which imposed "ludicrous 'beauty' standards [women] are conditioned to take seriously," feminists and beauty pageants have been at odds with one another. The research explores the relationship between feminism and the beauty pageant before and after the 1968 pageant protest through the use of film, both fictional and documentary. Before the 1968 protests, the pageant and its contestants received little criticism within a film. Movies like *Ella Cinders* (1926), *Juke Joint* (1947) and *Free and Easy* (1930) use the pageant as a little more than a plot device, an easy way to focus attention or send the character to Hollywood. Movies made after 1968, in particular *Smile* (1974), took an irreverent approach to pageants. The pageant and its contestants became an object for satire. However, recent films have moved away from this critical perspective and instead struggle to reconcile the tension between feminism and pageants. Three films, *Drop Dead Gorgeous* (1999), *Beautiful* (2000), and *Miss Congeniality* (2000), retained some of the satire of *Smile* but did not ultimately advance feminist concerns. They seem to focus most of their attention on excusing and explaining the value of beauty pageants. The question remains, if the once easily-criticized pageant returns to its former unimpeachable glory, what does this say about the future of feminism in America?

THE ARTS AND HUMAN HISTORY

PIOUS PAINTINGS: REPRESENTATIONS OF CHRIST IN GILDED AGE AMERICAN ART

JAMIE FRANKLIN, Art History, Junior, MARY GATES SCHOLAR
SUSAN CASTERAS, *Art History*

The theme of religion in nineteenth and early twentieth century American and British art was extremely popular. Unfortunately little research has thus far considered the various roles that religious art played in society and how religious art was affected by the social climate of the period it was created in. Under the mentorship of Professor Susan Casteras, who is researching the role of religion in Victorian period, 1831-1901, British art, I have learned the basic avenues of research on this topic. She has allowed me to pursue areas of personal interest and I have branched off to research the representation of Christ in American art of roughly the same period, ca. 1865-1914. I have looked at the religious climate of the day and at the personal religious background of the artists that created images of Christ. These two topics seem to be the most critical in evaluating this type of artistic endeavor. Starting around 1860 there was a dramatic intellectual shift that put Christianity under great pressure. This dramatic intellectual shift seemed to challenge biblical accounts of history and the whole of biblical doctrine. As a result American Christians reacted by emphasizing Christ's holiness and His image began to show up in American art much more regularly than before the Civil War. The manner in which artists treated Christ's image was dependent on the artist's own religious background. This is evidenced in the contrast of Henry Ossawa Tanner and Thomas Eakins. Tanner, who was a devout Christian, created very personal images of Christ. Eakins, who was an atheist, painted a Crucifixion that was seen as extremely ungodly and devoid of the holiness American Christians wanted. My research has shown how varied the representation of Christ was in the Gilded Age and some of the critical aspects that one needs to weigh when evaluating these representations.

WIELDING ART AND CULTURE: ZIMBABWEAN STONE SCULPTURE AND THE MARKET

LANCE LARKIN, Anthropology, Senior
CELIA LOWE, *Anthropology*

Though many studies have looked at the art of indigenous societies as an indicator of how much those societies have changed, there has been little research looking at the implication of these art objects on the people buying them. Specifically, how do the forms and stories behind the artwork affect the consumer, if at all? Do people discover more about these cultures through the artwork, or is the economic transaction completely superficial? By examining a contemporary African art form it is possible to analyze the conflicting claims of many different consumers. From art collectors who buy for aesthetics, to the tourist who buys to legitimize an experience, differing messages of why they buy compete for dominance in the dialogue. Unfortunately, this discourse ignores the reasons that the sculptor has created the artwork. After spending six months of data gathering in Zimbabwe, including over two months at a village sculptors' cooperative in the backcountry, this research examines the intersection of sculpture, many different buyers and sculptors. By analyzing these dynamics we are able to see that the artists use the stone sculpture movement as a transmitter of cultural agendas and as an agent for building nationalism in the post-colonial state.

THE FUTURE OF MEDICINE

Session Moderator: Wendy Raskind, Medicine

Student Moderator: Lynne Townsend, Neurobiology, Senior

A REPORTER FOR RADIATION DAMAGE IN *DEINOCOCCUS RADIODURANS*

ROGER HUYNH, Biochemistry, Senior

NORMAN DOVICH, Chemistry

AMY DAMBROWITZ, Chemistry

The bacterium *Deinococcus radiodurans* is one of the most radiation resistant organisms characterized to date. *D. radiodurans* has been extensively characterized in order to determine what unique cellular properties contribute to its radiation resistance. Currently, multiple strategies are being developed to engineer *D. radiodurans* for the bioremediation of mixed radioactive waste sites. To further our knowledge of the *D. radiodurans* radiation response, our group will characterize changes in the proteome of *Deinococcus radiodurans* in response to ionizing radiation at the single cell level. The goal of this project is to develop a reporter gene in *D. radiodurans* that will have expression proportional to the amount of ionizing radiation damage sustained by a cell. We plan to quantitate reporter gene expression by monitoring fluorescence from green fluorescent protein (GFP) expressed under the control of a radiation-responsive promoter. The reporter construct will consist of an integrated plasmid containing the GFP gene downstream of a radiation responsive promoter from *D. radiodurans*. A number of genes whose expression may respond to radiation damage have been identified. We will amplify the promoter regions of these genes and clone them into the GFP construct. To date there have been no published reports of successful expression of GFP in *D. radiodurans*. We have also devised an alternate strategy to test for radiation-responsive promoters. The promoters will be tested using a previously characterized *lacZ* reporter.

INDEXED GENOMIC PROFILING OF PROKARYOTES

RUSSELL BENEFIELD, Biochemistry and Cellular and Molecular Biology, Junior

NORM DOVICH, Chemistry

AMY DAMBROWITZ, Chemistry

The ability to distinguish between similar bacterial species, and between closely related bacterial strains, is essential in clinical microbiology. Current genotyping approaches offer advantages over traditional phenotypic methods for strain typing; however, these techniques do not yet provide the information density, cost-effectiveness, or specificity required by clinical laboratories or epidemiologists. DNA indexing offers an ordered, non-cloning approach for targeting, amplifying and isolating specific DNA fragments from complex genomic digests. Analysis of bacterial chromosomes by DNA indexing provides an information-dense molecular fingerprint generated by objective sampling of microbial genetic structure. It is proposed that the specificity, widespread applicability, reproducibility, and potential for high-throughput application of indexed genomic profiling (IGP) will make this technique an attractive method for microbial typing in clinical or research laboratory environments. I am working to develop the IGP approach to microbial molecular subtyping. Development of this technique has required the modification of existing DNA indexing protocols to compensate for the complexity of microbial genome analysis. This has yielded increased information density in experimental data, enhancing the resolving power of the microbial fingerprint generated by this method. The first application of the modified protocols will be to fingerprint and differentiate between several *E. coli* strains. This step will be guided by predictive modeling based on the published genomic DNA sequence of *E. coli* strain MG1655. It is anticipated that IGP will be of particular value in providing clinical microbiologists or epidemiologists with molecular fingerprints containing specific information regarding strain pathogenicity. Putative virulence or antibiotic-resistance gene regions can be specifically targeted and amplified. The reproducibility of IGP and the potential for its high-throughput application should also facilitate comparisons between laboratories, and the establishment of library catalogues with strain-specific IGP.

THE FUTURE OF MEDICINE

KARMELLAE FORMATION IN YEAST MUTANTS

NICOLE CHOW, Cellular and Molecular Biology, HOWARD HUGHES SCHOLAR
ROBIN WRIGHT, *Zoology*

Eukaryotic cells have the remarkable ability to read signals from their environment and respond by altering their internal cell structure. This process is involved in cell specialization, as all cells of the body originate from a single cell and differentiate into cells with different organelle structures based on their specific functions in the body. The question of how cells control their organelle biogenesis is not yet understood. In the Wright lab, research is done using the yeast *Saccharomyces cerevisiae* as a model to examine this question of eukaryotic cellular control. Under high levels of HMG-CoA Reductase, an enzyme regulating sterol synthesis, yeast cells were found to form elaborate stacks of proliferated endoplasmic reticulum membrane called karmellae. By studying the formation of karmellae, we will learn more about the overall process of cellular control. My project examines *ubc7* yeast mutants that are defective for a gene believed to be involved in the process of making karmellae. The *ubc7* protein is associated with the endoplasmic reticulum, and yeast strains with mutations in this gene grow poorly when karmellae are induced. Using fluorescence microscopy, I observed the formation of karmellae in these mutants and compared it to karmellae formation in the wild type yeast. I observed that the *ubc7* mutants have circles of disorganized membrane in the cell when the yeast cells form karmellae, and the wild type cells lack this excess membrane. The current hypothesis is that the membranes are important for modulating enzyme activity, but the significance of the membranes is under investigation.

RNA APTAMERS FOR THE HIGH MOBILITY GROUP PROTEIN XUBF1

JAMES A. TROY, Biochemistry, Senior
SNORRI TH. SIGURDSSON, *Chemistry*
JEFFREY D. WELLHAUSEN, *Chemistry*

Upstream Binding Factor (UBF) is a transcription factor involved in the regulation of RNA polymerase I (polI). UBF contains several High Mobility Group (HMG)-box domains, which have a highly conserved sequence that forms three alpha helices arranged in an L-shape. Studies show that some HMG-box proteins do not recognize a specific DNA sequence when binding the polI promoter region. These proteins bind tightly to certain nucleic acid structural features, such as cross-over DNA, 4-way junction DNA, cruciforms, and tRNA. This study applied the Systematic Evolution of Ligands by Exponential Enrichment (SELEX) procedure to determine the binding preferences of HMG-box domains. Random 42 and 70 nucleotide RNA sequences were selected for binding to the N-terminal HMG-box from *Xenopus laevis* UBF. RNA sequences that bound the target (aptamers) were amplified through twenty rounds of SELEX, cloned, and individually assayed. Aptamers bound with significantly greater affinity than the original random RNA pool. These aptamers are being compared for similar sequence and structural components.

THE FUTURE OF MEDICINE

ROTAVIRAL NSP3A PROTEIN INTERACTION WITH mRNA IN *E. COLI*

SERINE AVAGYAN, Biochemistry, Junior, PRESIDENTIAL SCHOLAR
STEVE MOSELEY, Microbiology
VANYA KOO, Microbiology

Rotaviral nonstructural protein NSP3A binds to the 3' end of viral mRNAs which end with a specific sequence GACC. NSP3A bound to mRNA interacts with the eukaryotic translation initiation factor eIF4G, enhancing the translation of viral genes. We utilized a system of mRNA processing in *Escherichia coli* to generate mutant mRNAs which end with the sequence GACC. This system will be used to study NSP3-mRNA interaction in vivo. The introduced mutations did not interfere with the correct processing of the mRNA in *E. coli*. We utilized primer extension analyses to determine the half-life of the wild-type and mutant messages. Half-lives of the wild-type and mutant mRNAs were essentially the same. Experiments are now in progress to determine the effects of the NSP3A binding on mRNA stability. We hypothesized that NSP3A binding will stabilize the mutant mRNA. If proven, this will permit structure-function analyses of the protein to identify the regions of NSP3A that are required for binding to the mRNA and therefore the translation of viral proteins. These studies will result in new basic information regarding nucleic acid-protein interactions in viral pathogenesis, and may contribute to the development of novel preventive and therapeutic strategies for the control of rotavirus infections.

THE ROLE OF THE M1 MUSCARINIC ACETYLCHOLINE RECEPTOR IN TYROSINE PHOSPHORYLATION OF THE N-METHYL-D-ASPARTATE RECEPTOR

HEATHER MCMAHON Cellular and Molecular Biology, Senior
NEIL NATHANSON Pharmacology
SUSAN HAMILTON Pharmacology

The N-methyl-D-aspartate (NMDA) receptor is an ionotropic glutamate receptor which is found primarily in the cortex and hippocampus of the mammalian central nervous system. This receptor is involved in learning and memory, and has been implicated in several neurodegenerative diseases including schizophrenia and AIDS-related dementia. Muscarinic acetylcholine receptors are G-protein coupled receptors which are involved in learning and memory, and in neurodegenerative disorders such as epilepsy and Alzheimer's disease. Activation of the M1 subtype of muscarinic acetylcholine receptor, which couples to the G_{aq/11} G-protein family, results in activation of protein kinase C (PKC). Previous research has shown that both muscarinic agonists and activators of PKC can induce a potentiation of currents through the NMDA receptor. In addition, activation of PKC by phorbol esters has been shown to induce tyrosine phosphorylation of the NR-2A and NR-2B subunits of the NMDA receptor. The goal of my project is to test the hypothesis that the M1 muscarinic acetylcholine receptor mediates tyrosine phosphorylation of the NR-2A and NR-2B subunits of the NMDA receptor. In order to test this hypothesis, we developed a system using brain slices from the hippocampus. We are examining changes in tyrosine phosphorylation after treatment with phorbol esters or muscarinic agonists using immunoprecipitation with antibodies specific to the NR-2A and NR-2B subunits, followed by western blot analysis using antibodies specific to phosphorylated tyrosine residues. We will examine differences in tyrosine phosphorylation of the NMDA receptor in neurons from wild type mice and M1 knockout mice.

“The [research] project was like the ribbon on top of a present, tying all things together and making it a great gift! It was the most beneficial experience of my academic career. I now feel that I can take the next step which is going on to graduate school.” - Senior, Aquatic and Fishery Sciences

“To do a project which is completely your own is both scary and rewarding. I’m really looking forward to being done and framing every single page to hang on my wall.” - Senior, Women Studies and Sociology

ACKNOWLEDGEMENTS

The Undergraduate Research Program wishes to thank all of the faculty members, staff, and graduate students who have contributed to the education of the undergraduate researchers featured in this symposium. None of this would have been possible without you.

We wish to thank all of the volunteers who helped to organize and run this event and the professors who released their classrooms for the symposium sessions: Jasmin Weaver; Allison Van; Jeffrey Giansiracusa; Meghan Pinch; Nels Jewell-Larsen; Emily Beyer; Roland Lopez; Matt Patterson; Shawn Landis; Amy Lu; Jeff Longnion; Anne Williams; Holly Atkinson; Steven Hardy; Jamie Franklin; Lynne Townsend; Jennifer Hempelmann; Eddy Ferre; Brooks Miner; Anita Salem; James Baxter; Jennifer Bean; Robert Boiko; Alan Borning; D. Cowan; Thomas Duchamp; Alon Halevy; Joseph Janes; Jonathan Mayer; Steven Seitz; Willis Konnick; Ana Mari Cauce; Harry Hayward; Bryan Jones; Paul LePore; James Ham; Leslie Meyer; Richard Karpen; Scott Noegel; Patrick Rivers; David Domke; Craig ZumBrunnen; Paul Boynton; Joel Migdal; Alexander Mamishev; Christine Ingebritsen; Frieda Taub; Billie Swalla; Christian Grue; Tom Daniel; Brian Reed; J. Nathan Kutz; Christopher Campbell; Elizabeth Von Volkenburgh; Cathy Beyer; Eve Risken; Wendy Raskind; Robin Wright; Vega Subramaniam; Roxanne Hamilton; Barbara Abruzzo; David Aldrich; Thomas Dicken; Joshua Gibbs; Roberta Hopkins; Linda Kemnitzer; Brenda Humphries; Christine Stickler; Mona Pitre-Collins; Michaelann Jundt; Cynthia Caci; Beret Kischner; Irene Svete; Dan Hough; Lupine Miller; Jennifer Dow; Wendy Durant; Pat Wrobel; Ken Etzkorn; George Bridges; Roy Bing Chan; Jodene Davis; Rachel Haagan; Sarah Cameron; Cristina Law; Heather Macdonald; Luke Butler; Megan Matthews; Max Hunter; Matthew Probert; Beret Kischner; Jason Johnson; Jason Boyd; Karen Trinh Ho; Pamela Tang; Dawit Teklemichael; Ona Anichello; all of the Gateway Center Staff; and everyone who has contributed to this event.

Special thanks to the Mary Gates Endowment for Students for its support of and encouragement of undergraduates in research. Special thanks as well to students and faculty from Stanford, Cal-Tech, UCLA, and WSU for coming to Seattle to participate in this event.

We express appreciation for sponsorship of this event to the UW Office of the President, Office of the Provost, Office of Research, and Office of Undergraduate Education.

