

Committee on Research Special Research Grants 2009-2010

Pranav Anand, Linguistics
Matt Wagers, Linguistics

The Distribution and Comprehension of Implicit Arguments

A core question in linguistics is how expressions are built from functions and their arguments, e.g. verbs and nouns. Generally all of a function's arguments must be pronounced. Certain arguments may remain implicit (i.e., unpronounced), but only as long as they are recoverable from prior discourse. This project investigates how this recovery procedure is similar to that of determining the antecedent of a pronoun, which is likewise a discourse-dependent process. Investigation will proceed along two lines: computational modeling and psycholinguistic experimentation. In the computational modeling component, we will annotate a large-scale corpus of conversational text for pronoun and implicit argument antecedents, leading to distributional analysis of the differences between these two expressions and computational models to capture these differences. In the psycholinguistic component, we will investigate to what extent people's cognitive processes (specifically, attentional focus and memory-sensitive behavior) during comprehension of implicit arguments and pronouns are distinct. One important effect we will investigate is how prior discourse context may bias a comprehender towards the recovery of particular values for a given implicit argument. Both components will target implicit spatial and experiential perspectives (e.g., "delicious" [to whom?]), an understudied area in the linguistic sciences.

Adrian Brasoveanu, Linguistics

Logic Puzzles and the Discourse Semantics of Quantification

Formal semantics aims to provide a mathematically precise characterization of natural language interpretation, e.g., we characterize the meaning of sentences like "Linus entered the room" and discourses like "Linus entered the room. He sat down" in as precise a way as the meaning of equations like $2+3=5$ is characterized in elementary arithmetic. That is, we associate each word "Linus", "enter", "he" etc. with a precisely defined meaning in much the same way as the symbols 2 , $+$, 3 , $=$ etc. are associated with precisely defined meanings: 2 , 3 etc. denote certain numbers, $+$ denotes an operation over numbers etc.

Given some familiarity with mathematical logic, we can see how to start developing such a project. It is, however, less obvious how to characterize the denotations of quantifiers like "each car", "two riders", "no man", adjectives like "same" and "different" etc.

These phenomena are amply exemplified in LSAT logic puzzles. Here's one example: "An amusement park roller coaster includes five cars, numbered 1 through 5 from front to back. Each

car accommodates up to two riders, seated side by side. Six people - Tom, Gwen, Laurie, Mark, Paul and Jack - are riding the coaster at the same time.”

The project will investigate these phenomena by providing a systematic formal analysis of a corpus of logic puzzles and computationally implementing this analysis to test its viability.

Emily Brodsky, Earth & Planetary Sciences

Rapid Drilling to Measure the Friction of a Major Earthquake

Measuring the temperature on a fault at depth is the best way to determine the resistance to motion provided by friction. As the two sides of the fault slide past each other, they heat the fault zone and thus generate a record of the friction. If a hole is drilled fast and deep, this transient signal can be captured. Currently, just such a borehole is being drilled in Sichuan, China through the fault that generated the devastating Mw 7.9 May 12, 2008 earthquake. This COR proposal is designed to enable my participation as an international collaborator in the temperature measurements on the fault. A second goal of the proposal is to prepare the scientific response to a similar earthquake in the United States by constructing a database of available boreholes near major faults in California. The proposal is leveraging the \$20M Sichuan drilling project funded by the Chinese government as well as a \$39K NSF Small Grant for Exploratory Research (SGER) already awarded to me specifically for instrumentation for the Sichuan project.

Jeffrey Bury, Environmental Studies

The Icy Edge of Climate Change: Glacier Recession and Adaptive Governance in the Andes

This project evaluates the impacts of recent climate-change related glacier recession on human populations in the Andes. Through the use of case-study research and mixed analytical methods, the proposed project will evaluate the shifting relationships between environmental systems and human vulnerability and adaptive capacity in the Cordillera Blanca, Peru. In particular, the research will: (1) assess how human vulnerability is changing in response to glacier recession related hydrological variability and regional shifts in weather and climate patterns; and (2) evaluate how changing household access to resources is affecting livelihood adaptive capacity and social resilience. The expected outcomes of this work include the generation of empirical and theoretical insights into human livelihood vulnerability and adaptation, the strengthening of inter-institutional collaborative research partnerships, the generation of more extensive extramural funding proposals, the creation of new undergraduate instruction and graduate training opportunities and the extension of outreach activities that will assist local people and governance institutions in their efforts to adapt to and mitigate the worsening impacts of climate change, glacial recession, and water scarcity in the Andes.

Elisabeth Cameron, History of Art and Visual Culture

A Post-Colonial Church Architecture in the Congo

This research project will explore local church architecture in Kananga, capital of the Kasai Occidental Province, the Democratic Republic of the Congo (DRC), through photography, recording of floor plans, and interviews with architects and builders in June/July 2009. Local church architecture is key to understanding the role small local churches, based in colonial pasts but now a grassroots movement, have played during the humanitarian and political struggles of this country since independence in 1960.

The 19th century “Scramble for Africa” altered and continues to affect the face of the African continent. Scholars have studied colonial and post- colonial Africa but only recently has the missionary presence received serious consideration. Christian missionaries arrived in the Congo at the end of the 19th century and served to enforce and question the effects of colonialism. The Christians introduced new regulated forms of sacred and secular architecture. Although not always appropriate for local climate and practice, the rules of church architecture, based in Judeo-Christian traditions, were strictly followed during the colonial era. With national independence, however, many local churches separated from their foreign parent institution. Newly independent churches began to experiment with church design and construction, creating a post-colonial structure that reflects local realities.

Manel Camps, Microbiology and Environmental Toxicology

Generation of an annotated library of second-site suppressors of green fluorescent protein for computational modeling of epistasis

The effect of multiple mutations on protein function frequently does not represent the sum of individual constituent mutations. This phenomenon (epistasis) has enormous evolutionary implications.

Scarcity of functional data represents the main limitation for the study of epistasis. To address this problem, I propose creating an empirical set of coordinated epistatic substitutions. I have chosen green fluorescent protein (GFP) as a model because GFP provides an instant, quantitative readout of activity, greatly facilitating annotation of the libraries. My experimental approach involves identifying single, point mutations that abolish GFP fluorescence (GFPlow mutants). Next, random mutant libraries of GFPlow mutants are made and screened for fluorescence. As anticipated, this approach yields both direct reversions and second site suppressors. Second-site suppressors are epistatic by definition. I would like to create a large database epistatic interactions that can be used for computational modeling. I have established a collaboration with a laboratory specialized in anticipatory models of mutation (Rachel Karchin, Johns Hopkins). My collaborator will process the database to identify biophysical variables that correlate with epistatic behavior. Further, she will develop statistical models that relate these properties to

changes in protein activity. This work should impact the fields of genomics, genetics and protein engineering.

Benjamin Carson, Music Theory and Composition

Pieces, Threaded 1999-2009: Piano Music of Ben Leeds Carson

Most of the time when we sit down at the piano we are not so much playing an instrument, in the usual sense, as interacting with a visual and tactile model of a musical world view. The piano aspires to representations of unbounded musical possibility, in ways that are both distinctive to the instrument, and indifferent to it. Ten years ago, as I set out to compose new music for piano, the tensions between the piano's uniqueness, and its pretenses to a kind of universality, concerned me.

The piano is at first a keyboard, and displays the keyboard's attractive logic of tonal movement. A responsive machinery connects the keyboard—an orderly digital interface—to a resonating body. *Piano*, meaning "soft": a half-hearted finger's *sotto voce* might sink toward the very bottom of musical awareness, but still fill an 18th-century concert stage like the smallest organ pipe fills a cathedral. *Forte*, strong: in the 19th century, the revolutions of the late 1700s slipping into the past, and the revolution of clocks and steam engines under way, the pianist's full hands and taut hammers somehow remain at the center of a Romantic world. The pianoforte was everything from a soft-touched toy of family parlors, to a hero's throne before the orchestra. Later, a medium of French symbolism, luminescent and weightless, yet heavy and arrogant enough to survive any future: tonality's disintegration, the drum-driven back beats of swing, and the global electricity of Chicago blues. How do all of these historical meanings affect the way we hear the instrument now? Is there a way to reinvent the instrument?

The pieces on this disk include *Pieces, Threaded*, a collection inspired by German expressionist poetry and Argentine political non-fiction, "*Fors seulement...*", *fors seulement condition*, based a chanson by Ockeghem, *Coda: "You Are Not I"* (in memory of Paul Bowles), *Plain-clothes cop*, and a thirty-eight minute work titled *Persistent Names of Lost Spaces*. In all of these works, I have tried to address the possibility of a meaningful, 'present tense', pianistic action. This does not mean not that the music is somehow separate from the piano's historical meaning, or from what the piano has already become. But the piano exists for me as a set of possibilities, which, although coexistent with the narratives and definitions that history has so thickly constructed around it, are still on the margins of common musical experience, and still in need of exploration.

Brian Catlos, History

Muslims of Latin Christendom, ca. 1050-1615

The eleventh century, the dawn of the Crusading Age, brought significant Muslim populations under Western Christian rule for the first time. For the next two hundred years there were significant Muslim minorities in Iberia, Italy, Hungary the Mediterranean islands, North Africa and the Holy Land, not to mention Muslim slaves distributed throughout Europe. As a consequence of the “roll back” of Crusader states and expulsions, after 1300 only the Iberian Muslim communities remained. These proved extremely durable, surviving forced conversion in the 1520s, and persevering until a mass expulsion that ended in 1615. Traditionally regarded as a marginalized, passive under-class, research in the last decades has shown that Muslim minorities were dynamic societies that took an active role in their own survival. Moreover, they were often highly integrated with both the Christian societies within which they lived, and their Jewish neighbours, and made a considerable impact on the development of European culture. This project takes an interdisciplinary approach to study the impact of the Latin West on medieval European Islam and of these populations on the development of the West. It is by nature transnational and comparative, and will be the first substantial study of this important minority.

Sharon Daniel, Film and Digital Media

The Social-Cost Price-Tracker: an art work for mobile devices that will provide a tool for grass-roots consumer activism and an interface to an evolving, participatory media documentary on the social costs of consumer culture

The Social-Cost Price-Tracker will allow consumers to trace and compare the “social cost” of commercial products using their own cell phones. The phrase “social cost” here refers to both the human capital exploited and the natural resources expended in the production of consumer goods. The Price-Tracker will be unique among cell phone applications and art works for mobile device interfaces in its focus on the social cost of consumerism and its solicitation of community participation. The research is part software development, part new media documentary and part invention in media form – an effort to develop both a tool (or means to an end) and an end in itself (an evolving participatory-media “documentary”). The Price-Tracker’s media-rich database of images, audio and video recordings documenting the conditions of employment across industries should enhance consumer awareness of the role of often exploited and marginalized laborers in the consumer “food chain” and, hopefully, contribute in some small way to the creation of more ethical government labor and wage policies. The Price-Tracker’s collaborative and open framework should increase public participation in the creation and distribution of both information and capital and thus facilitate the evolution of a more just and sustainable society.

Mayanthi Fernando, Anthropology***Tensions of Secularism: Muslim Citizens in the French Republic***

I am applying for funds to complete research for my first book, entitled "Tensions of Secularism: Muslim Citizens in the French Republic," which examines 1) the religious sensibilities and political subjectivities constituted by Muslim-French citizens, and 2) the secular institutions, discourses, and political and legal practices that seek to manage Islam. I ask how Muslims of North African descent draw on and reconfigure both the Islamic and republican traditions as they fashion new ways of being and thinking. I also explore tensions within the republican tradition that emerge in its encounter with Islam: tensions, for example, between universal and particular in conceptions of national identity, and between the distinct spheres of "religion" and "politics" that ostensibly define laïcité (French secularism). By conceptualizing Muslim citizens as already French, I move beyond questions of immigrant integration towards a reconsideration of citizenship and civic life, in France and in Europe more generally. I also consider secularism beyond the realm of political theory by focusing on the institutional and legal practices that comprise laïcité. Finally, my ethnographic approach enables me to examine how Muslim citizens, caught in structural and discursive tensions endemic to secularism, bear the political, legal, and moral burden of these tensions.

Camilla Forsberg, Biomolecular Engineering***Flk2 regulation of hematopoietic stem cell function***

To improve the clinical efficacy and safety of cancer therapies, it is crucial to understand the molecular mechanisms that control normal cell development and how dysregulation of this process leads to cancer. The tyrosine kinase receptor Flk2 plays a critical role in hematopoietic stem cell (HSC) proliferation and fate decision. The constitutively activated mutated forms of Flk2 are now recognized as the most common molecular abnormality in Acute Myeloid Leukemia (AML). To determine the role of Flk2 in both normal blood cell development and cancer, we will use HSC from normal mice and mice lacking a functional Flk2 receptor. We will compare the proliferation of HSC in liquid culture and determine the role of Flk2 in the balance of HSC quiescence and proliferation, and subsequently in fate decision. Although a number of clinical trials are currently targeting Flk2 for therapeutic intervention in AML, optimal use of agents modulating Flk2 activity requires a better understanding of hematopoietic stem cell fate decision and proliferation. The outcome of this study will enhance our understanding of the basic biology of stem cells and directly benefit their clinical use to improve the safety and efficacy of cancer and stem cell transplantation therapies.

Mark Franko, Theater Arts

Martha Graham in the 1940s: From Antifascism to Myth, and Psychodrama

Martha Graham is a major artistic figure of the twentieth century whose impact is usually compared with that of Picasso, Stravinsky, and Joyce. The period of her artistic maturation overlaps the global crisis of fascism, World War II, and the immediate post-war period ushering in the Cold War. My book concerns Graham's work and life between 1938 and 1953. It includes in-depth studies of five key works -- "American Document" (1938), "Appalachian Spring" (1944), "Dark Meadow" (1946), "Night Journey" (1947), and "Theatre for Voyage" (1953) -- in relation to Graham's antifascism between 1938 and 1944, and her reputed abstract expressionism in the post-war period. This study places the major canonical works in a new interpretive perspective, and also reveals an entirely forgotten work. It will contribute to the reassessment of abstract expressionism in the visual arts from the perspective of choreography. I shall draw heavily on private correspondence. This new view presented of Graham will be both more intimate and more theorized than has previously been possible. Because of recent lifting of restrictions on the primary research material this project also gains urgency.

Shelly Grabe, Psychology

Collaborative Research: Property, Empowerment, and Gender-Based Violence in Rural Tanzania

Violence against women is the most pervasive human rights violation in the world. Throughout East Africa, and Tanzania in particular, domestic violence is widespread. Additionally, rates of HIV infection among women have greatly increased within Tanzania where institutional factors threaten women's freedom from sexual violence. Such trends continue unabated despite widespread commitments to draw attention to the prevalence and consequences of control over and violation of women's bodies. Furthermore, economic policies of the 1980s and '90s introduced or exacerbated several structural factors that contributed to rising levels of gender inequity. This is particularly visible within the area of property rights. However, these two major violations of women's rights – violence and property rights—have been addressed independently of each other. We hypothesize that lack of secure land ownership contributes to a system in which female subordination is maintained as reflected by high levels of violence and lack of reproductive choice. Scholars from Psychology, Geography, and Political Science will investigate whether and how (i.e., via psychological empowerment) land ownership relates to domestic violence and HIV-risk. Questionnaires and techniques adapted from the World Health Organization will be used to administer household surveys to 300 women. In-depth qualitative assessment will be used to inform survey data and gain a more in-depth understanding.

Miriam Greenberg, Sociology***Cities and Crisis: Power, Image and the Reinvention of New York and New Orleans***

I seek funding for the second phase of a research project comparing the roots and ramifications of the crises of September 11th in New York and Hurricane Katrina in New Orleans. My goal is to produce a proposal and two chapters of a book, tentatively titled *Cities and Crisis*. The book will contextualize these recent crises and recovery strategies by providing a comparative historical and sociological analysis of the role of political economy, city-branding, and social movements in both cities since the 1970s.

The first phase of the project entailed collaborative research with a colleague at Tulane University on the market-centered, or “neoliberal,” restructuring that was implemented in both cities in the immediate wake of these crises. This grant will enable me to take this research many steps further, and to expand my research focus, methodology, and theoretical approach. My hypothesis is that New York and New Orleans constitute a new model of post-disaster urban development, which I will refer to here as crisis-driven urbanization. At the same time, these two cities serve as the grounding for a broader theoretical framework for understanding the increasing scale and incidence of crisis for cities in general, a dynamic that I will refer to as the urbanization of crisis.

Claire Gu, Electrical Engineering***Photovoltaic Cells on Side-Polished Optical Fibers***

We propose to investigate the applications of side-polished optical fibers in photovoltaic cells. The demand for high efficiency and low cost photovoltaic cells is increasingly urgent under the current economic and environmental challenges. Previously, optical fibers have been used to make photovoltaic cells to increase the efficiency of light usage [1]. The problem with such a fiber photovoltaic cell is that the existing cladding of the multimode fiber prevents the light from being coupled out of the core and into the organic photovoltaic cell. In this research, we propose to investigate two roles of the side polished fiber: 1) a flat polished side coated with organic photovoltaic materials sandwiched between electrodes as the optical-electrical converter, and 2) a lens-like polished tip to increase the efficiency for light reception. The results of this research will be used as preliminary results in our proposals to NSF and/or other funding agencies.

Melissa Gwyn (Miller), Art
Scott Lokey, Chemistry
David Deamer, Physical Sciences
Frank Galuszka, Art

"Full Disclosure" Exhibition Catalogue

We are seeking funds to create an exhibition catalogue to document a cross-discipline collaboration between the sciences and the arts at UCSC. The exhibition, entitled "Full Disclosure", will open in September 2009 at the UCSC Sesnon Art Gallery. The catalogue will be coordinated, managed and distributed by the Sesnon Gallery. The show will feature artifacts from science faculty and new work created by arts faculty in collaboration with science faculty and researchers. The exhibition will include scientific drawings, models from laboratories, large paintings, small magnetic sculptures, video interviews with researchers, and computer animations accompanied by signage that explains the research behind the science and the ideas behind the art. The unifying themes for the exhibition will focus on process and the role of failure in creative and analytic endeavors. The exhibition catalogue will document this joint venture between the sciences and the arts. This soft-bound seventy-page catalogue on premium quality paper will feature gallery installation photos, reproductions of the projects, a lead essay by an art critic who also writes about science, an essay about creativity and failure written by Professor Frank Galuszka, and essays by UCSC professors Scott Lokey, myself and others. It will be published after the exhibition.

Grant Hartzog, Molecular, Cell, and Developmental Biology
Joe Konopelski, Chemistry
Scott Lokey, Chemistry

Using Chemical Genetics to Identify a new Molecular Target for

Breast cancer is the second leading cause of cancer deaths among US women.

Most breast tumors are dependent on the hormone estrogen and the estrogen receptor (ER). An important strategy for chemotherapy of breast cancer uses Selective Estrogen Receptor Modulators (SERMs) to interrupt estrogen receptor function. Tamoxifen is a widely used SERM with proven benefit in treatment of ER-positive breast tumors that also protects against development of breast tumors in high-risk populations. A less-appreciated aspect of Tamoxifen is that it also has ER-independent effects. We have found that tamoxifen and tamoxilog, a potent tamoxifen analogue that we discovered, are toxic in brewer's yeast, an organism that lacks estrogen or other steroid hormone receptors. Our analyses suggest an ER-independent target of these drugs in yeast. The goals of this proposal are to: identify the target(s) of tamoxifen and its analog; determine if these compounds target related molecules in human cells; and determine if the new tamoxifen analog targets ERs and thus functions as a SERM in humans. Completion of these Aims may help us to identify previously unappreciated targets of tamoxifen that mediate its ER-independent effects and that play a role in its therapeutic efficacy or in its side effects.

Wendy (Dee) Hibbert-Jones, Art***Unstable Matter***

Unstable Matter is an investigation of the sculptural object in the face of a world in international economic turmoil, and a society drowning in a surfeit of things. Utilizing metaphors such as the search engine, or a DJ mixer I will select, cast and assemble disparate objects into sculptural forms. Combining, juxtaposing and fracturing each objects' individual meaning to create sculptures that represent our present unstable state, disrupting sculptural notions of stability and security. I will begin by casting public objects that represent security and infrastructure such as fire escapes; street signs and emergency telephone boxes. These casts will be recreated as real-scale flaccid versions of the originals, floppy polyurethane shadows of the actual forms. I will combine these cast objects with found objects and building materials. The resulting sculptures aim to challenge notions of sculpture as permanent memorial, monumental icon and reflect our current state of cultural and economic crisis . I intend these sculptural works to be icons to feelings of instability and dis-ease, and to examine the role of sculpture in the 21st century. Each constructed object is carefully fabricated despite an aesthetic of haphazard construction, providing commentary on contemporary feelings of economic instability, global insecurity and environmental crisis.

Lindsay Hinck, Molecular, Cell, and Developmental Biology***Characterization of SLIT tumor suppressors***

In the United States, one woman in eight will develop breast cancer in her lifetime. My laboratory has recently identified a gene family, called Slits, that functions as breast tumor suppressors. We have discovered that Slit1 inhibits tumor growth by inhibiting the ability of tumor cells to divide, whereas Slit2 inhibits the growth of blood vessels required for tumor sustenance. We seek funds for a pilot study that will elucidate, at the molecular level, changes that occur in tumor cells due to expression of Slit genes. This will be accomplished using the new technique of SOLID sequencing available to researchers at the UCSC Genome Center. Information gained by this study will be used to obtain external funding from the NIH and other organizations that support breast cancer research.

Athanasios Kottas, Applied Mathematics and Statistics

New statistical methods for modeling and risk assessment for developmental toxicology data

Birth defects induced by toxic chemicals can be investigated through developmental toxicity studies. The main purpose of these studies is to examine the relationship between the level of exposure to the toxin (dose level) and the probability of malformation. Parametric statistical methods are routinely utilized to model this relationship through standard distributions and parametric forms for the probability of malformation as a function of dose level. A key objective is "toxicity risk assessment", that is, estimation of dose levels that correspond to specified malformation probabilities. However, the data structures are generally very complex and difficult to model with standard parametric statistical approaches. We propose to develop new general statistical models that overcome the limitations of existing techniques. A key feature of these models is that they allow flexibility in the functional form for both the distribution of positive responses (i.e., response to the toxin) and the probability of malformation, while appropriately incorporating the multiple sources of heterogeneity. To our knowledge, this will be a novel methodological addition to the literature on statistical techniques for developmental toxicology data. As importantly, from a practical decision-making point of view, we anticipate that the proposed statistical modeling framework will result in significant improvements on inference for toxicity risk assessment.

Irene Lusztig, Film and Digital Media

The Worry Box Project, an experimental documentary film and companion website

I am applying for funding to support the preproduction / development stage of "The Worry Box Project," a new long-form experimental documentary film project and companion website meditating on the anxious state of contemporary American motherhood.

Combining history of science, women's studies, and anthropological research practices, the film will interweave contemporary documentary material with a visual / archival history of the childbirth / childcare education film in the 20th century as well as staged performances of pregnant women recounting their anxiety dreams. Taken together, these diverse visual strands will form a multi-layered cine-essay problematizing the manufacturing of motherhood as identity, ideology, scientific construct, and psychological state.

In tandem with my work on this film, I plan also to create a website that will serve both as a gathering mechanism to collect narratives of anxiety from a broad range of mothers and mothers-to-be (some of which will be culled to use in the performance segments of the film), and also as a freestanding parallel art project in its own right. Based on the concept of a virtual "worry box," visitors to the website will be able to anonymously submit a written worry; they will also be able to view the waking anxieties and anxiety dreams of other women. Posited against a contemporary motherhood culture that has become relentlessly optimistic and positive, the virtual "Worry Box Project" provides a safe collective space for women to articulate fears,

worries, and negative feelings about motherhood that will contribute to the polyvocal form of the film.

Roberto Manduchi, Computer Engineering

MapScribe: Accessing Maps without Sight

We propose to develop and test a system that will allow a blind individual to access graphical information (specifically, a map). The idea is to combine an embossed map (which is a well established tool for graphical exploration without sight) with ancillary information access via a new and successful user interface device, the Pulse Smartpen produced by Livescribe. When used with a special type of paper, the Smartpen is able to infer the position of its tip, and thus it could convey location-based information (such as the name of a street) to the blind user as he or she is exploring the map. This project has the potential to substantially improve the user experience of a blind person interacting with an embossed map, and therefore to provide the blind community with a new and powerful tool for information access. Beside map exploration, this system may find broader application, for example in the field of education in geometry and geography for blind children.

Travis Seymour, Psychology

Individual Differences in Multitasking

I am applying to support my research on individual differences in multiple-task performance. This project aims to show that contrary to popular theories, some people can simultaneously perform multiple tasks without any decrements in performance compared to only one task in isolation. My work suggests that despite the difficulty of learning to expertly multitask, various individual differences, training protocols, prior experience, and other task factors influence performance. We use an “Evil Wizard” videogame task in which the wizard throws virtual knives at the participant which must be blocked using keypresses (Task 1). Sometimes the wizard will try to utter cast verbal incantations that participant must counter by uttering counter words into a microphone (Task 2). Sometimes both tasks are presented simultaneously and participants must respond to both quickly and accurately. Participants will practice the task for 4 1-hour sessions. Beforehand, they will complete a survey of of their everyday multitasking activities. I predict that most will be able to increasingly overlap processing of the two tasks with practice. I also predict that those with high pre-experimental multitasking experience will show no dual task cost by day four, whereas those with little experience will continue to show costs.

Donald Smith, Microbiology and Environmental Toxicology

GPP 130 protects against cellular manganese toxicity: Implications for neurodegenerative disease

Elevated exposure to manganese (Mn) is neurotoxic and known to cause the neurodegenerative disease Mn-induced Parkinsonism. This proposed research will test the hypothesis that golgi membrane protein GPP130 is a mediator of cellular Mn uptake and cytotoxicity, and thereby complete our preliminary dataset necessary for an NIH R01 application planned for submission end 2009. GPP130 is a Golgi-localized integral membrane protein that cycles to endosomes where it mediates endosome-to-Golgi retrieval of other cycling Golgi proteins. Our objectives are to (1) knock down or over-express cellular levels of native GPP130 in immortalized rat and human neuronal cells using RNAi or a doxycycline-inducible over-expresser system, (2) determine the impact of GPP130 on cellular Mn uptake, efflux, and Mn accumulation, and (3) determine the role of GPP130 in mediating cytotoxicity of Mn using cell viability and MTT mitochondrial function assays. Our preliminary studies in neuronal cells have shown that elevated Mn exposure causes a rapid and selective cellular relocation and degradation of GPP130, reducing GPP130 levels in the cell to <10% of normal. However, the mechanisms that underlie this effect and the implications of GPP130 depletion on endosomal trafficking and cell toxicity from Mn are not known.

Elizabeth Stephens, Art

Goodbye Gauley Mountain

I am requesting funding to create a film titled “Goodbye Gauley Mountain,” to explore the environmental and cultural devastation caused by the coal mining technique known as mountain top removal (MTR). The narrative will weave autobiographical information with environmental consequences through the ongoing story of the destruction of Gauley Mountain.

My grandfather invented a coal bit to increase coal production in the 1930’s. He opened a machine shop, created a successful business, and raised his family at the foot of Gauley. I spent my childhood there. Being informed that Gauley Mountain was being mined using MTR suddenly made this issue very personal for me and spurred me to action.

In the West Virginia coalfields the climate between mining, environmentalists, and communities that are affected by and economically dependent on coal is highly contentious. Strong feelings abound on both sides of the MTR debate. This radical mining technique has decapitated 470 mountains so far and is tearing the social and environmental fabric of Appalachia apart. In this film footage of MTR sites juxtaposed with shots of unspoiled Appalachia, interviews with people associated with the coal industry, as well as environmental activists and community leaders will show the story of an epic fight for survival.

Michael Stone, Chemistry and Biochemistry
William Scott, Chemistry and Biochemistry

How Does a Mammalian Ribozyme Riboswitch Work?

Two recent discoveries in molecular biology involve RNA. The first is that RNA, like proteins, can catalyze biologically important chemical reactions (these are called ribozymes). The second is that RNA is intimately involved in programming and regulating gene expression in several ways, including RNA interference (RNAi) and riboswitches (RNA structures that turn gene expression on and off). One of our research groups discovered a ribozyme that can, like a riboswitch, turn off gene expression in various mammalian gene transcripts. We now need to understand how these sorts of ribozyme riboswitches can be turned on and off in mammalian cells. To elucidate this new mechanism of gene regulation, we will employ single molecule techniques to directly characterize RNA structural changes required for modulating catalytic activity. By combining the expertise of our two research groups, one of which specializes in ribozyme structure and catalysis, and the other, which specializes in single molecule structural studies, we will develop the experimental methodology that will enable us to answer the critical mechanistic question of how this new form of gene regulation works. The results from the proposed experiments will enable us to pursue external funding for this and similar experimental problems.

Wang-Chiew Tan, Computer Science

Automatic Generation of Examples to Illustrate Database Constraints and Queries

Database constraints form a primary component of any database management system (DBMS). It is a high-level declarative specification of the "shape" of data that resides in a DBMS and is typically leveraged by the DBMS to optimize access to data. Recently, constraints have also been used as a language for the design and specification of the relationship between different data sources, and they are the underpinnings of several research areas, including data integration, data exchange, and peer data management systems. Prior studies have shown that the process of obtaining a correct specification of the relationship between data sources is often a difficult one; a significant amount of work is typically involved in understanding and adjusting an initial specification until a correct specification is obtained.

The goal of this project is to develop a principled system that will aid the process of designing a specification. The basic idea is to automatically generate small and meaningful examples that will illustrate the semantics of the underlying specification. We envision that the technology behind our research is also applicable to the development of a pedagogical system for explaining, with examples, database constraints and queries to students of an undergraduate or graduate database course.

Karen Yamashita, Literature

Japanese American Wartime Internment Archives Research

The Yamashita Family Archive contains an estimated 500 letters and numerous documents from 1936 to 1948, collected among seven siblings dispersed to Topaz Internment Camp in Utah and subsequently across the country. These letters reveal detailed events, in particular, personal accounts of Kay Yamashita's work with Nisei Student Relocation and John Yamashita's postwar work at Oakland West 10th Methodist Church. Of particular interest are the family's relationships to members of the Quakers, the Fellowship of Reconciliation, the Methodist and Baptist Churches, and to Howard Thurman of the Fellowship Church. The proposed project will extend research to archives and histories of those individuals and organizations identified within the Yamashita Archive who gave support to the Japanese Americans during this period. The end product will be a book to preserve and publish Nisei wartime narratives and to give context to converging histories of outsiders and the larger Civil Rights Movement.

Erika Zavaleta, Environmental Studies

Informing Climate Change Models with Ecological Data: Valley Oak Woodlands in California

Current climate response models are limited in their ability to accurately project future species distributions. Incorporation of range-wide ecological data into these models would insert important biological dynamics, allow model refinement, and clarify the role models can play in anticipating species responses to climate change. Valley oak woodlands found only in California provide an ideal system for developing these kinds of climate change model refinements. Research has been conducted on valley oak woodlands for nearly half a century, and basic climate response models have been developed for them. I propose to augment an ongoing but under-resourced effort by my research group to survey valley oak woodlands throughout their California range to understand how climate and biological factors limit them, how climate change has affected them in the last 3-5 decades, and how existing climate response models – both for valley oaks and for species in general – can be improved with biological data. This award would support purchase of modest, but much-needed, field equipment and supplies; travel to 20 of the 60 sites in the state that we must survey; and student field research assistance for the labor-intensive field survey process.

Martha Zuniga, Molecular, Cell, and Developmental Biology
David Haussler, Biomolecular Engineering

Genetic and functional analysis of ankylosing spondylitis, an inflammatory autoimmune disease

Genetic factors and external stimuli both contribute to autoimmune disease, but elucidation of how one's genetic composition together with environmental factors, such as infection, cause autoimmune disease remains elusive. A particularly challenging complication is the fact that any given autoimmune disease may have more than one etiology, so that different combinations of genes and environmental factors are causal in different cases. Genes that correlate with some autoimmune diseases have been identified. However, for most autoimmune diseases it remains unclear how a given genetic signature predisposes a patient to disease. The HLA-B27 gene is present in 90-95% of patients diagnosed with the autoimmune disease ankylosing spondylitis. More recently, another gene, ARTS1 (or ERAP), whose protein product can affect the immune function of HLA-B27, was implicated in ankylosing spondylitis. We propose to take advantage of UCSC's new and powerful DNA sequencing technology and its internationally recognized genome browser to sequence and analyze the HLA-B27 and ERAP genes of individual ankylosing spondylitis patients and normal controls. We will then introduce the patient-specific variants of these genes into cells and analyze the molecular interactions of their gene products to determine how specific genetic changes in these genes affect the immune function of HLA-B27.

Eileen Zurbriggen, Psychology

UCSC Dating Study Follow-up: Sexual Objectification and Well-Being

We live in a culture in which women are often objectified -- turned into objects for the use and enjoyment of others. This objectification has serious consequences for women, putting them at risk of depression, low self-esteem, and eating disorders. As well, it creates a climate in which violence against women is more likely. This study provides a deeper understanding of the negative consequences of being objectified by examining a variety of potential consequences including physical and mental health, self-esteem, and well-being. As well, it investigates the consequences of objectifying other people, including a possible increased risk of aggression perpetration. Study participants will be recruited from students who took part in the UCSC Dating Study, a two-wave longitudinal study funded by the National Institute of Mental Health. By collecting a third wave of data, we can answer important questions about the processes whereby people learn to think of themselves and others in objectifying terms. As well, this project will allow for an investigation of long-term (rather than just immediate) consequences of objectification.