

**Research Initiation Program
Award Recipients
2009-2010**

Dr. Mustafa Atay
Computer Science
College of Arts and Sciences
Award: \$9250.00

Proposal Title: "Performance Evaluation of XML-to-SQL Query Translation Techniques"

Abstract: XML, the eXtensible Markup Language, emerged as the standard for representing and exchanging data on WWW and gained a considerable popularity in the last decade. The huge trend in adopting XML is driven by its semi-structured, self-describing and extensible data model which enables defining arbitrary languages. There are numerous XML-based markup languages developed to provide common data standards in many areas including science, engineering and business. The increase in the size of XML data has raised new challenges such as managing large sizes of XML documents. Several researchers have proposed to use the mature relational database technology to store and query large sizes of XML data. The performance of query processing in a relational XML storage system is closely related to the query translation technique employed in the query mapping stage. Three major techniques are identified to translate XML queries into SQL queries which are ID-based, interval-based and path-based query translations. A performance study of all three major XML-to-SQL query translation techniques for schema-based relational XML storage systems is missing in the XML literature. The problems of which one of the query translation techniques outperforms the others, or, which query translation technique should be chosen under certain conditions, are still open in the schema-based XML storage space. We will do a performance evaluation study to address these issues. Our study will shed light to research and development on XML data management systems and will lead to more efficient systems for industry and researchers who use large sizes of XML data.

Dr. JoAnne Banks
Department of Nursing
School of Health Sciences

Proposal Title: "Interconnections between Self-Silencing, what it means to be a Good Woman" or "Strong Black Woman", and Physical Activity Behavior: A Mixed-Method Study"

Abstract: Regular physical activity (PA) positively affects disease risk reduction and promotion of overall well-being. Despite the known health benefits, many do not regularly participate in PA. Moreover, PA participation decreases across all groups with age. African American women participate in less PA than almost any other group. The literature does not show effective strategies to help African American women incorporate routine PA into their lives across the lifespan.

Published literature suggests that African American women's perceptions of the "good woman" or "strong Black woman" constructs may lead to self-silencing, which may cause them to care for others at the expense of their own health. However, how these perceptions factor into health-related decision-making behavior, particularly regular PA is unknown.

This study will use surveys and individual interviews to gather preliminary data concerning self-silencing among African American women 35 years of age and older, the potential value of self-silencing as a predictor of PA behavior, and the ways in which perceptions of self as either a “good woman” or “strong Black woman” affect self-silencing behavior. Target sample size is 30 women. This study’s **Primary Aim** is to evaluate the potency of African American female self-silencing as a predictor of PA behavior. A **Secondary Aim** is to elicit women’s perceptions of the relationships among “strong Black woman,” “good woman,” self-silencing, and PA participation. The anticipated outcome is more (and more effective) strategies for helping African American women incorporate routine PA into their lives.

Dr. Glenna Batson

Physical Therapy

School of Health Sciences

Proposal Title: “Effect of an intensive trial of modern dance on balance and mobility in a group of adults with early-to-middle stage Parkinson disease: A pilot study”

Abstract: Adults with Parkinson disease commonly suffer falls and other mobility problems. While a cure for these problems is elusive, exercise that incorporates cueing appears to enhance movement ease and safety. Various exercise programs have advocated incorporating visual- or rhythmic cues into exercise for correct body placement and movement timing. Of the approaches tried, none has emerged as the most effective. Modern dance recently has shown promise as an accessible, inexpensive, and enjoyable method of exercise for enhancing overall body awareness and mobility. In a recent study, a group of adults with Parkinson’s reported cognitive, physical, and psychological improvements after participating in a 2-month (once a week) modern dance class. Only self-reported surveys were used to evaluate effectiveness, however. This pilot study is designed to measure the objective outcome of a 2-week intensive trial of modern dance on long-term mobility, balance, and balance confidence in a single group of adults with early-to-middle stage Parkinson disease. Dance content will include rhythmic accompaniment to movements based on functional everyday activities (sitting, standing, and walking). Clinical measures of balance and mobility will be taken immediately before and after the study. At termination, each participant will receive a guided CD-ROM home exercise program, and follow-up measures will be repeated at 2 months to assess long-term carryover. The study also proposes to examine the benefits of group-delivered exercise in this population, and to support health disparities research by recruiting adults with Parkinson disease potentially excluded from select healthcare treatments. Further randomized controlled studies are planned.

Dr. Manjunatha Bhat

Life Sciences & Project Strengthen

College of Arts and Sciences

Proposal Title: “Calcium Signaling Mechanisms in Sensory Neurons: Toward understanding mechanisms of acute and chronic pain”

Abstract: Calcium (Ca^{2+}) is important for many neuronal functions such as excitability, gene expression, and survival. Neurons utilize two main sources to maintain their intracellular Ca^{2+} homeostasis and control their functions: (i) extracellular Ca^{2+} entry across the plasma membrane and (ii) Ca^{2+} release from the intracellular stores. Ryanodine receptor (RyR) is a Ca^{2+} regulated Ca^{2+} release channel in the endoplasmic reticulum (ER). Sustained ER Ca^{2+} release in response to cell stimulation leads to a secondary Ca^{2+} entry

through a mechanism called capacitative Ca²⁺ entry (CCE), which helps in restoring ER Ca²⁺ balance.

In this application, we propose experiments aimed at investigating Ca²⁺ signaling through these above two mechanisms in sensory neurons. This study is based on our preliminary experiments that demonstrated the following novel findings: (i) Both small diameter neurons that transmit pain signals (i.e. nociceptive) and large diameter mechanosensitive neurons show rapid Ca²⁺ release from the ER upon activation of RyR; (ii) only nociceptive neurons exhibit a sustained Ca²⁺ entry through the CCE pathway. These results show important differences in the ways by which intracellular Ca²⁺ is regulated in neurons of different sensory functions. Characterizing these differences and elucidating the mechanisms by which these neurons maintain and regulate their intracellular Ca²⁺ homeostasis are critical to our understanding of the process by which organisms detect, transmit and process signal inputs of different sensory modalities such as normal touch and noxious stimuli such as pain.

Studies proposed in this application will provide the foundation for seeking funding from federal agencies (NIH and NSF) for future continuation of research in Dr. Bhat's laboratory.

Dr. Gary Bond

Behavioral Sciences and Social Work

College of Arts and Sciences

Proposal Title: "Distributed Team Laboratory for Investigating Collaborative Learning, Trust, Communication, and Performance"

Abstract: Teams play an increasing role in many aspects of work performed by business, government, and the military. The growing complexity of work frequently surpasses the cognitive capabilities of individuals and thus, necessitates a team approach (Cooke et al., 2000). A team is different from a group in that teams work temporarily to solve problems or perform tasks, and team members have distinct roles and duties. Teams may be formed and may conduct their tasks in face-to-face contexts (co-located) or virtual contexts (distributed). A growing body of research examines team-level behaviors, including training (sales, Nichols, & Driskell, 2007), collaborative learning (Soller, Goodman, Linton, & Gaimari, 1998), knowledge and performance (Banks & Millward, 2007), learning and transfer in context (Lee, Bond, Scarbrough, Gillan, & Cooke, 2007) and other team-level aspects. However, existing research in team trust and how trust behaviors, trustworthiness, and antecedents to trust formation lead to greater or worse team performance is inadequate (Lee, Bond, Russell, Gonzales, and Scarbrough, submitted). Trust is important to teamwork, trust in information sources, information and larger system networks are important; yet few studies investigate trust on any of these levels. The Army Research Laboratory has recently called for programmatic research in systems networks, from teams to larger systems, and has identified research on trust as particularly important in studying system networks. The PI plans to equip a networked team laboratory to conduct pilot studies in co-located and distributed collaborative learning, trust, and performance, so that proposals for external funding can be facilitated.

Dr. Charles Ebert

Chemistry

College of Arts and Sciences

Proposal Title: "Dynamics of Keratin-Induced nerve Regeneration"

Abstract: The field of regenerative medicine seeks innovative medical therapies that will enable the body to repair, replace, restore and regenerate damaged or diseased cells, tissues and organs. One challenge facing regenerative medicine treatments is producing cellular scaffolds that will allow cells to grow in the particular manner necessary to repair traumatic wounds, such as peripheral nerve injuries (PNI).

Current studies are investigating a number of synthetic and natural scaffolding biomaterials that may guide cells in forming functional tissue structures *in vivo*. Among the most promising is keratin derived from human hair. Keratin is an extracellular matrix protein that has been well-characterized structurally; however, recent studies suggest keratin has a far less well understood regulatory role. Keratin self-assembles into molecular scaffolds, promotes growth of neurogenic Schwann cells across nerve gaps, and then degrades as cells proliferate. Animal trials have shown that regeneration of nerve cells across a gap is statistically as effective as allografts of donate nerve.

What remains a mystery is exactly how keratin promotes Schwann cell growth. Keratin contains numerous binding domains and exhibits a high degree of variation among tissues, suggesting that keratin has both functional and structural roles. The goal of this investigation is to characterize the specific aspects of keratin that are involved in recruiting and regulating regenerative cells within the body, identifying regulatory small molecules and ligand-binding motifs. By understanding how keratin promotes cellular regeneration, one can design more efficient regenerative treatments. Ultimately, one may be able to completely regrow damaged nerves.

Dr. Sayo Fakayode

Chemistry

College of Arts and Sciences

Proposal Title: "Bioanalytical Investigation of Binding of Chiral Drugs on Biological Samples"

Abstract: The binding of chiral drugs molecules with biological samples has a significant influence on physiological, pharmacological activity, drug potency and biochemical processes in humans. Thus, a fundamental understanding of the binding mechanism of chiral drugs on biological samples is critically needed in the medical, biomedical and pharmaceutical research communities for effective drug discovery, drug metabolism, and disease control. The ultimate goal of this research study is to develop a high-throughput analytical technique for the investigation of the binding mechanism of chiral enantiomer drugs and chiral environmental pollutants with biomolecules as well as investigation of biomolecular chiral discrimination and enantio-selectivity of chiral molecules in biological systems using Fourier transform infrared (FTIR) spectroscopy, guest-host chemistry, circular dichroism and polarimetry. Specifically, the binding sites of warfarin and 1-methoxy-2-propanol on human serum albumin (a carrier and transportation medium for drugs and metabolites), lysophosphatic acid (a potential biomarker for various pathological conditions, including ovarian cancer) and 1- α -lysophosphatidylcholine (a major structural phospholipid in the brain) as well as the influence of experimental factors including pH, temperature, and complexation medium on guest-host complexes will be investigated. In addition, the chirality and specific optical rotation of guest-host complexes formed between

warfarin and 1-methoxy-2-propanol on human serum albumin, lysophosphatic acid and l- α -lysophosphatidylcholine will be probed using circular dichroism spectroscopy and polarimetry.

Dr. Mohammad Fuad
Computer Science
College of Arts and Sciences

Proposal Title: "An Explanation Based Learning Algorithm for Self-Managing Distributed Applications"

Abstract: Day-to-day maintenance of a distributed application is a big challenge due to the fact that the runtime environment changes continuously and the application can behave completely differently because of that. Users of such systems want to run their application and do not want to worry about the mundane task of system management in the face of a failure. If such management scenarios come into existence, the user wants the runtime environment to handle those situations autonomically and hide all the complexity related to such management actions. The user is more concerned with timely execution of his/her computation and production of intended results. Especially in academia, where scientists from discipline other than computing want to run their distributed computation, they do not have the knowledge of dealing even with the mundane failures in the system. It will be of tremendous benefit to scientists and researchers in non-computing discipline, if their distributed computing task autonomically manages itself and produces correct results in timely fashion with minimal user interaction for system management. This proposal wants to investigate the implementation of an explanation based learning algorithm, the essential building block for envisioning such system, which learns its actions with minimal (or even no) user involvement to self-manage the system. We plan to use code transformation and injection techniques to incorporate the learning algorithm with existing application without users doing any additional programming. Once such a modified application is in play, we would be evaluating our approach with qualitative measures and with quantitative benchmarking technologies.

Dr. David Kump
Life Sciences
College of Arts and Sciences

Proposal Title: "Melanocortin-3-receptor regulation of skeletal muscle mass"

Abstract: The purpose of this proposal is to study how muscle mass is regulated by a gene called melanocortin-3-receptor (MC3R). This is one of a family of five receptors that are activated by peptides (small proteins) called melanocortins. Various studies provide evidence that the MC3R is involved in a number of important processes in the body. Some of these processes include inflammation, body fat balance, and blood pressure that is sensitive to more salt in the diet. Mice that do not have MC3R have the same body weight as mice that do, but the mice without MC3R have more body fat and less lean tissue; the decrease in lean tissue is partly accounted for by a lower muscle mass. Because little is known about how melanocortin peptides act through the MC3R, this proposal aims to study how MC3R is found in muscle, 2) establishing a cell culture model of the effect of melanocortin on muscle cells for the purpose of examining how melanocortin work through MC3R, and 3) discovering what genes related to muscle mass have their expression altered in mice that lack MC3R. This work will advance the understanding of melanocortin biology, which is becoming increasingly important as pharmaceutical companies aggressively

pursue melanocortin as anti-obesity and anti-inflammatory drugs. Completion of this work should provide sufficient evidence to support future grant applications to external agencies.

Dr. Michael McKenzie

Human Performance and Sports Sciences

School of Education and Human Performance

Proposal Title: "Markets of Oxidation Stress Following a Single Aerobic Exercise Bout in Different Ethnic Groups"

Abstract: Oxidative stress is a normal process which occurs in everybody's cells. However, periods of uncontrolled stresses can lead to a variety of conditions, such as cancer, aging, and heart disease. It is well known that exercise causes an increase in these stresses. Regular exercise will eventually lead to increased defenses against these stresses. There are several measures where Caucasians and African Americans differ in regards to health. These 2 groups are known to have different bone densities, muscle densities, hormone levels, as well as carry fat differently. To date, no known investigation has examined if a difference exists in the amount of damage seen following a single exercise bout is the same. Using untrained college aged females; we will test every subject's maximal aerobic fitness. At a later date all subjects will return and run for 30 minutes at 70% of their maximal level. Immediately before and after the run, a small amount of blood will be taken for various analyses. We will determine in either ethnic group has more damage to their proteins, fats, or anti-oxidant defense system compared to the other group. This will enable future researchers to know if different ethnic groups may respond to a variety of things differently, such as diseases, medications, and even exercise.

Dr. John Merle

Physical Sciences

College of Arts and Sciences

Proposal Title: "Computational Studies of Protonated Peptide Fragmentation in Tandem Mass Spectrometry"

Abstract: In this study, the fundamental chemistry leading to fragmentation of protonated peptide molecules in the gas phase will be explored. This chemistry is extremely important to the field of proteomics, where tandem mass spectrometry (MS/MS) is used for the identification of potential biomarkers for disease and cancer. In tandem mass spectrometry, a gas phase protonated peptide is selected and then excited by collisions with other gas particles causing it to break apart. If it breaks apart in a predictable fashion we may be able to determine the peptide's structure and identify the parent protein biomarker. Molecule modeling tools will be used to predict the favorability of potential fragmentation reactions via calculations of reaction thermochemistry. In the initial phase, the reaction thermodynamics for adding a proton at multiple locations on a peptide molecule will be calculated. Proton location is important because many fragmentation reactions are expected to occur at the protonated site. The energies of numerous peptide and protonated peptide structures will be evaluated using the following methods in the order: (1) Monte Carlo searching with molecular mechanics, (2) semi-empirical quantum mechanics, (3) ab initio or density functional theory. Each level providing a higher degree of accuracy and reliability. In the second phase, MS/MS spectra of the modeled protonated peptides will be produced using a mass spectrometer maintained by Dr. Clarke in the Life Sciences Department. The results from both sets of data will be examined for correlations between proton addition thermochemistry and experimental fragmentation pattern.

Dr. Kevin Ritsche

Human Performance and Sports Sciences

School of Education and Human Performance

Proposal Title: "The Growth Hormone Adaptation to Sprint Exercise Training in African Americans and Its Relationship to Lean Body Mass"

Abstract: Major health problems such as obesity, diabetes and heart disease are related to changes in body composition. Increased lean muscle mass can improve metabolic rate and hinder disease progression. The acquisition of lean muscle mass is controlled by a variety of hormones, one of which is growth hormone (GH). In addition, GH has been linked to decreased fat mass, reduced abdominal obesity, and increased exercise capacity. The proposed study will utilize three weeks of sprint exercise training as a stimulus to evaluate GH secretion in humans. We propose that long-term physiological changes, such as increases in lean muscle mass and subsequent weight reduction, may be dependent on the exercise-induced growth hormone secretion. Furthermore, this study is part of a long-term program of research in which we are evaluating how modifiable variables (body composition and exercise training) as well as non-modifiable variables (ethnicity) may influence exercise-induced GH secretion. The rationale for this study is to evaluate ethnic differences related to exercise endocrinology and its affect on exercise hindering the development of certain metabolic disorders. More specifically, this study desires to examine ethnic differences in exercise-induced growth hormone secretion and its relationship to lean body mass. This information is pertinent to identifying interracial differences that can influence the way certain ethnic groups are prescribed exercise in order to maximize efficiency. Thus, ethnic differences discovered in exercise-induced growth hormone secretion will allow medical supervisors to utilize specific forms of exercise as a healthy, non-pharmaceutical intervention to encumber metabolic disorders in minority populations.