

2003-2004 Undergraduate Research Award Scholars
Statements of “Specific Aim(s), Purpose(s) or Goal(s)”

Kevin P. Allen, *Mathematics & Statistics*, “A Matrix-Free Implementation of the Conjugate Gradient Method for Cluster Computing”, (Faculty Mentor: **Dr. Matthias K. Gobbert**, *Mathematics & Statistics*)

Tentative Graduation Date: Spring 2004 (M.S.)

“The purpose of this research is to fully optimize the conjugate gradient method for use as the computational kernel for the time-stepping in a system of reaction-diffusion equations. The conjugate gradient method is applied to a large, sparse, highly structured linear system of equations obtained from a finite difference discretization of the Poisson equation. The matrix-free implementation of the matrix-vector product is shown to be optimal with respect to both memory usage and performance. The parallel implementation of the method can give excellent performance on a cluster of workstations, with the optimal number of processors depending on the quality of the interconnect hardware. Our goal is to have the best method available for use in our application.”

Akua N. Bonsra, *Biochemistry and Molecular Biology*, “Boric Acid – Catalyzed Epoxide Hydrolysis”, (Faculty Mentor: **Dr. Dale Whalen**, *Chemistry and Biochemistry*)

Tentative Graduation Date: Spring 2004

“[The purpose of this project is] to conduct research in an organic chemistry lab at UMBC to explore the hydrolysis of carcinogenic epoxides by boric acid. This research will be presented at national conferences and, perhaps, be published in a scientific journal. More importantly, this project will provide me an opportunity to do research and provide a hands-on laboratory experience that no course could teach. I intend to pursue a Ph.D. in the sciences, particularly pharmacology, to become a research scientist. This project will not only allow me to do what I enjoy but it will also give me an opportunity to contribute to the scientific community.”

Mandi Brown, Dance, “Dancing at the Source: Paul Taylor Summer Dance Intensive”.
(Faculty Mentor: **Professor Doug Hamby, Dance**)

Tentative Graduation Date: Spring 2004

“My goal is to create a performance work using the choreographic processes and techniques exclusive to the Paul Taylor Dance Company...The Paul Taylor Dance Company is one of the most influential modern dance companies in the world. Paul Taylor has mastered the use of spatial dynamics and syncopated rhythmic changes. The energy and drive that his dancers use to dart across a stage is captivating. Additionally, lyrical qualities in a work such as “Aureole” (1962) are surreal and magical. Paul Taylor has captured the pinnacle of human movement. By immersing myself into this environment I will be able to test myself by dancing next to some of the world’s most experienced professional modern dancers.”

Roland Cheung, Biological Sciences, “Testing Mitochondrial Phylogenies – Nuclear Intron Sequencing for the Baltimore Oriole Group” (Faculty Mentor: **Dr. Kevin Omland, Biological Sciences**)

Tentative Graduation Date: Spring 2004

“The goal of the Omland lab is to use evolutionary trees to study plumage evolution and speciation in orioles (Icterus). The lab has already constructed a tree based on mitochondrial DNA. (Omland et.al. 1999)

The purpose of my proposed research is to test mitochondrial phylogenies using nuclear genes. Although the study of animal evolution has been revolutionized by mitochondrial DNA sequences, phylogenies based on mitochondrial DNA may be misleading in certain cases. Fortunately, nuclear DNA can be used since it is not related to mitochondrial DNA. With this in mind, the proposed research hopes to use nuclear intron DNA as a new source of information to determine the validity of the mitochondrial evolutionary tree.”

Robert Daber, Biochemistry & Molecular Biology, “Identification of Trauma in Humans” (Faculty Mentor: **Dr. Brian Bradley, Biological Sciences**)

Tentative Graduation Date: Spring 2004

“The main purpose of this project is to determine protein expression signatures for trauma in humans. These signatures, when compared to protein signatures of the individuals when they are not in trauma as well as to other control signatures, will allow for identification of key proteins specific to each condition. From this, the identification of key proteins in trauma victims can be made, which would allow for a test to determine the state of an individual at the scene of an accident.”

Nina Nell Haeckel, *Biological Sciences*, “Miss Marple would be pleased: her literary goddaughters have taken the female investigator to new heights” (Faculty Mentor: **Dr. Kenneth Baldwin**, *English*)

Tentative Graduation Date: Fall 2004

“This is an examination of the changes in the perceptions of the capabilities of female investigators in the mystery genre. It will compare the capabilities and characteristics of several of the earliest female detectives, including Agatha Christie’s Miss Marple and Leslie Ford’s Grace Latham, with contemporary characters. Modern characters in this genre are representative of a wide variety of women of different ethnicities, classes, and the literature does not constrain them to the stereotype of working for the police or as a private detective.”

Jackie Heilman, *Chemistry and Biochemistry*, “Branched-Chain Alkylation of Exocyclic Amino Groups of DNA by Primary Diazonium Ions” (Faculty Mentor: **Dr. James C. Fishbein**, *Chemistry and Biochemistry*)

Tentative Graduation Date: Spring 2004

“The goal of this research is to determine the extent to which the products of alkylation of the exocyclic nitrogens of guanine and adenine, N6 isopropyl adenine and N2 isopropyl guanine, are formed relative to other DNA adducts. Other possible adducts include bases containing n-propyl lesions at exocyclic nitrogens and oxygens and n-propyl and isopropyl lesions at endocyclic nitrogens. All of these products could result from the reaction of a primary diazonium ion, which may react directly with DNA or undergo hydride migration to form a secondary carbocation prior to reaction.”

Colin Holter, *Music (Composition)*, “Sextet for Flute, Clarinet, Violin, Cello, Piano, and Vibraphone” (Faculty Mentor: **Dr. Linda Dusman**, *Music*)

Tentative Graduation Date: Spring 2005

“I plan to compose a new major work for a professional ensemble. As a second-year music composition major at UMBC, my broader goals include disseminating my work, building my resume, having my pieces played by reputable performers, and of course refining my craft. To accomplish these goals (both specific and general), I am planning to attend one of two summer programs that will augment my compositional experiences at UMBC with new perspectives and outside influences.”

Elizabeth Humphries, *Biological Sciences and Chemistry & Biochemistry*, “The Relationship Between Sexual Dimorphism and Migratory Behavior in the Baltimore Oriole” (Faculty Mentor: **Dr. Kevin Omland**, *Biological Sciences*)

Tentative Graduation Date: Fall 2004

“Sexual dimorphism is a widely-studied topic in evolutionary biology. It occurs in species where the male is brighter than the female. (For example, in Baltimore Orioles, the male is black, orange and white, whereas the female is olive-yellow.) In contrast, other species are monomorphic, where the adult male is indistinguishable from the adult female. Why organisms are dimorphic (or why the male looks different from the adult female) is an intriguing topic. In the oriole genus, some of the species are dimorphic (the Baltimore Oriole) while others are monomorphic (e.g., the Streak-backed Oriole). The northern migratory species tend to be dimorphic (with dull-colored females) and the southern non-migratory species tend to be monomorphic (with brightly colored females).”

Among males, brighter coloring is thought to aid in territory defense. A male with very bright colors or elaborate feathers will be more likely to guard the area he chooses for breeding season. In contrast, the dull females are not believed to assist in territory defense. In migratory species, the breeding season tends to be short. The males are likely to arrive in the breeding area earlier and stake out their territories. This would allow the females to focus solely on nest-building and other breeding tasks when they arrive. Non-migratory species usually have a longer breeding season than their migratory relatives. The females would not be as hard-pressed to begin breeding immediately and could theoretically help establish and defend the territory. This project will examine the extent of territoriality in the females of a northern dimorphic species, the Baltimore Oriole. The orioles will be studied to see if the males do indeed arrive earlier and what the females do once they arrive. The data will be compared to similar data collected by other members of the Omland lab on a related southern monomorphic species, the Streak-backed Oriole.”

Emily Junod, *Social Work & Health Administration Policy Program*, “Zurich & Baltimore: A Comparative Study of Drug Treatment Centers” (Faculty Mentor: **Dr. Claudia Lawrence-Webb**, *Social Work*)

Tentative Graduation Date: Spring 2004

“I plan to conduct a comparative case study to explore the organizational response and community perception of drug treatment services in Switzerland and Baltimore, Maryland. The purpose of this research is to determine if services are similar or different in nature and whether or not community perceptions are supportive or unsupportive of such programs. My goal is to highlight the comparative aspects of services in Switzerland and the U.S. as a means of providing guidance and information

for the development and implementation of future drug programs, especially in Maryland, while garnering and maintaining community support. [I will research this] As well as explore the U.S. insight to positive and negative aspects of the impact those services made on Swiss society, and the impact of similar services in Baltimore.”

Neeraj Kashyap, *Mathematics & Statistics*, “Graph Theoretic Approaches to the Analysis of Constraint Satisfaction Problems” (Faculty Mentor: **Dr. Marie desJardins**, *Computer Science*)

Tentative Graduation Date: Fall 2003

“Constraint satisfaction problems are a special class of mathematical problems in which the goal is to assign values from a set called the universe to a set of variables with constraints imposed upon them. Our goal is to generate a method which, when applied to any constraint satisfaction problem, will predict how difficult it will be to solve. Such a method would come packaged with a method to actually solve constraint satisfaction problems, which would enable us to write software which we could then distribute.”

Maria Llewellyn, *Mathematics & Computer Science*, “Mining of Microarray Data” (Faculty Mentor: **Dr. Francoise Seillier-Moiseiwitsch**, *Mathematics & Statistics*)

Tentative Graduation Date: Fall 2003

“At the conclusion of my research I will have examined different methods for analysing microarray data. I will concentrate on support vector machines and neural networks, and specifically, contrast their influences made from gene expression. DNA microassays, consisting of thousands of individual gene sequences printed in a high density array on a glass microscopic slide, provide a practical and economical tool for studying gene expression on a very large scale. Perhaps the greatest challenge now is to develop efficient methods for organizing, distributing, interpreting, and extracting insights from the large volume of data these experiments will provide.” [1] Different methods of interpreting the data could lead to different answers as to the role of a specific gene in a given disease. To that end, I intend to perform experiments using support vector machines and neural networks to explore the different inferences learned from each.”

Tomasz J. Macura, Mathematics and Computer Science, “Detecting Spheres in Computed Tomography Using Parallel Computers” (Faculty Mentor: **Dr. Matthias Gobbert, Mathematics & Statistics**)

Tentative Graduation Date: Spring 2004

“The goal of the proposed research project is to develop an algorithm – General Sphere Detection Algorithm (GSDA) – that will detect spheres in three-dimensional datasets in real-time (less than two seconds per data-set). To achieve the necessary performance, the algorithm will be designed to run on a parallel computer.

We believe that developing a general parallel sphere detection algorithm will be original research on an interesting problem that has not yet been solved. We also believe that such an algorithm will have many applications in important domains, specifically Thoracic CT studies for detecting lung-cancer.”

Samuel Merenbloom, Chemistry, “Ion-Pair Reversed-Phase High Performance Liquid Chromatography for the Separation and Purification of In-Vitro Transcribed RNA Strands” (Faculty Mentor: **Dr. Dan Fabris, Chemistry and Biochemistry**)

Tentative Graduation Date: Spring 2004

“My research project involves testing whether Ion-Pair Reversed-Phase High Performance Liquid Chromatography (IP-RP HPLC) can be used to achieve fractionation of in-vitro synthesized RNA samples for Mass Spectrometric (MS) analysis on our Fourier Transform Ion Cyclotron Resonance (FT-ICR) mass spectrometer. This task will require screening different types of ion-pairing reagents to obtain efficient separation without degradation of sensitivity and resolution in the MS analysis. As soon as the separation conditions will be optimised using the UV detector, we will interface the HPLC to the FT-ICR instrument to perform direct Liquid Chromatography-Mass Spectrometry (LC-MS) analysis of the RNA products, bypassing many onerous purification steps once required for in-vitro transcription.”

Eleftheria Papavasilis, History, “Keystone Patriots: Women Soldiers of Pennsylvania Regiments During the American Civil War” (Faculty Mentor: **Dr. Anne Sarah Rubin, History**)

Tentative Graduation Date: Spring 2004

“The goal(s) of this project include the following:

- I aim to research the presence of Pennsylvanian women soldiers in the ranks during the American Civil War*
- I aim to further educate myself and others not only about how these women defied 19th century ideals, but I also seek to better understand their motivations,*

experiences, concerns and battle participation as members of the Pennsylvania Militia during the American Civil War.

- *I will present my research in a living history presentation dressed as a woman soldier, and I will produce a supporting paper illustrated with a corresponding poster display.”*

James Justin Plakas, *Visual Arts*, “Hip-Hop Tokyo”, (Faculty Mentor: **Professor Vin Grabill**, *Visual Arts*)

Tentative Graduation Date: Spring 2004

“My goal is to make a 15-minute film about the influence of the uniquely American culture of ‘hip-hop’ on youth in Japan. Through experimental documentary technique, I will seek to explore the specific appeal of the five main components of hip-hop (Rapping, Dee Jaying, Graffiti, Break Dancing and Fashion) to Japanese youth. I will also explore how they have merged Japanese culture – exceedingly unique itself – with that of American hip-hop, born and shaped within the African-American communities of urban America. While documenting this cross-cultural sociological phenomenon, I envision the film will also come to be a commentary on the global appeal of not only hip-hop but also of American culture in general.”

Justine D. Wagner, *Modern Languages & Linguistics, Economics*, “Legal minimum wages in Costa Rica and their effects on actual wages, employment, and income inequality” (Faculty Mentor: **Dr. T. Gindling**, *Economics*)

Tentative Graduation Date: Spring 2004

“The goal of my research is to measure the impact of legal minimum wages on actual wages, employment, and income inequality in Costa Rica. The legal minimum wage system in Costa Rica is much more complicated than that of the United States. Separate legal minimum wages are established for over 300 different categories of workers, depending on the worker’s industry, occupation, and skill level. Due to the complicated nature of this system, it has been difficult for past researchers to measure the effect of legal minimum wages on the actual wages received and employment of workers.

A first step in such an examination is to match worker-specific legal minimum wages with the available data on the actual wages of workers in Costa Rica. In other words, to match the industry/occupation/skill level categories in the household surveys that contain data on the wages and employment of individual workers. Because differences in the specific wording of these categories often arise, to begin research one must possess a strong knowledge of both Spanish and economics. To bring this project to its completion, it is essential to have an equally strong knowledge of the manner in which legal minimum wages are enforced by the Costa Rican Ministry of Labor. I already possess a strong

knowledge of Spanish and economics; however I do not possess sufficient knowledge of the legal minimum wage system in Costa Rica. Therefore, I am requesting funding from the Office of the Provost to travel to Costa Rica and conduct interviews with the employees of the Ministry of Labor and members of academic."