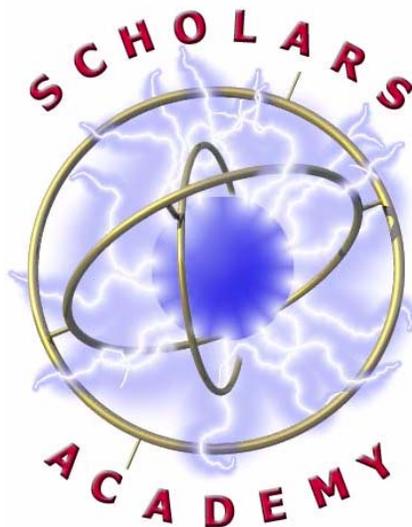




Proceedings

College of Sciences and Technology
STUDENT RESEARCH CONFERENCE
Sponsored by the UHD Scholars Academy



Friday, Nov. 8, 2002
Special Events Center



We are pleased to present the proceedings of the 2nd Annual College of Sciences and Technology Student Research Conference held at UH-Downtown on Friday, November 8, 2002. Thirty-six high achieving UHD students presented findings from their undergraduate research experiences orally and in poster presentations. We are proud of them for undertaking “optional” academic projects here at UH-Downtown and elsewhere in corporate and competitive academic internship programs. We are also proud of the effort they put into their presentations, and trust that each student presenter found the experience to be personally challenging and rewarding. The feedback about the conference from the UH-Downtown community, including administrators, was very positive and uplifting. The work of these students is an inspiration to others and a testament to the excellence of science, mathematics and engineering education at UHD. It is especially gratifying to see the conference serve as a springboard for participation in regional and national conferences, as happened with almost half of this year’s presentations.

The conference was sponsored by the UHD Scholars Academy, an academically competitive program in the College of Sciences and Technology (CST) that promotes scholarship and student success for undergraduate students majoring in Science, Technology, Engineering and Mathematics (STEM). The Student Research Conference was supported with a grant from the U.S. Department of Education, grant number P120A020069. Although this funding made the conference possible, the student presenters, their faculty mentors, and university administrators made it the success that it was.

Phyllis Baudoin Griffard, Ph.D.
Director
UHD Scholars Academy

PROGRAM

- 9:00-9:40 Keynote Speaker - Dr. Miguel Paredes
Professor of Mathematics
University of Texas – Pan American
- 9:50-11:00 Student Oral Presentations
- 11:00-12:30 Open Poster Presentations

Conference Co-Chairs: Dr. Byron Christmas, Dr. Ermelinda DeLaVina, and Dr. George Farnsworth



Drs. Carol Vobach, Ermelinda DeLaVina, Mitsue Nakamura, faculty in the Department of Computer and Mathematical Sciences



Scholar Fanny Cardenas, senior in Control Systems and Instrumentation, presents an engineering technology project to others.



Teresa Martinez, junior in Industrial Chemistry, presents her research on polymer chemistry.



UHD faculty and students

Program

Oral and Poster Presentations:



Lin Ahmad, "Redevelopment of GraphDraw, A program for drawing simple graphs"
Faculty Sponsor: **Dr. William Waller**
Project Sponsor: UH-Downtown

This work presents the redevelopment of the GraphDraw program using Java. GraphDraw was previously developed by Dr. William Waller using Visual Basic. GraphDraw is used to draw simple graphs. This program complements Dr. Ermelinda DeLaVina's Graffiti.pc program by providing users with the ability to draw graphs visually. The facility of drawing such graphs visually is not available presently in Dr. DeLaVina's program. A number of functionalities are provided in drawing the graph, and at the same time the program enables the users to read and write graphs, and to import and export graphs from and to Dr. DeLaVina's Graffiti.pc program.



Joseph Boley, "A Numerical Analysis on the Beta-IG Model of Diabetes"
Faculty Sponsor: **Dr. Elias Deeba**
Project Sponsor: UH-Downtown

Diabetes is a disease which causes the body to improperly produce or use insulin. Insulin is a hormone that regulates glucose levels in the body. Insulin is secreted by pancreatic beta cells. Diabetes is characterized by abnormal beta cell mass, reduced insulin secretion, and a reduced effectiveness of insulin. The Beta-IG model of diabetes was developed to couple established methods of modeling glucose and insulin dynamics with beta cell mass dynamics. My numerical analysis focuses on the following topics: Solve the Beta-IG model as an initial value problem; Observe and verify the critical points of the Beta-IG system; Given values for Beta-IG as t_0 and expected values at t_1 , determine what values should be controlled to regulate the system; and Refine the Beta-IG model to more accurately model the body.



David deRoode, "Population Studies of Potential West Nile Virus Mosquito Vectors in Houston, Texas"
Co-authors: **Kerri Newton** and **Jeffrey W. Flosi**
Faculty Sponsor: **Dr. Jeffrey Flosi**
Project Sponsor: UH-Downtown Medical Entomology Lab

Population studies of potential West Nile Virus mosquito vectors were conducted in the "inner-loop 610" area of Harris County, Texas from September 23, 2002 until November 1, 2002. This study was concentrated mainly on collecting *Aedes aegypti* (Linnaeus) (*the Yellow Fever Mosquito*), *Aedes albopictus* (Skuse) (*the Asian Tiger Mosquito*), and *Culex quinquefasciatus* (Say) (*the Southern House Mosquito*) in an effort to isolate the West Nile Virus and further study its transmission and pathogenicity. Parallel to this effort, environmental conditions, such as precipitation, temperature, and wind, were closely monitored and correlated with the populations of mosquitoes collected in CDC light traps (Sudia and Chamberlain 1962), as well as the population density measurements such as mosquito landing rate counts and site-specific larval counts.



Kelly Wroblewski, "A Look at Triangles with Graffiti.pc"
Faculty Sponsor: **Dr. Ermelinda DeLaVina**
Project Sponsor: UH-Downtown

This presentation includes the resolution of some conjectures of Graffiti.pc, a program written by Ermelinda DeLaVina. The conjectures are bounds on the graph invariant *number of triangles*. Results of this research are related to a problem addressed by Robert Cowen and William Emerson in the paper *On Finding k_4 ($k_3 \leq x$)*.

Poster Presentations:



Larry Bellot, "Signaling Pathways Mediating Growth and Anti-apoptotic Effects of Progastrin on Rat Intestinal Epithelial Cell Lines"

Co-authors: **Azar Owila** and **Pomila Singh**

Faculty Sponsor: **Dr. Akif Uzman**

Project Sponsor: University of Texas Medical Branch – Galveston

The IP3/AKT pathway is implicated in proliferation and cell survival of various cancer cell lines. Progastrin (rhPG) exerts similar effects on rat intestinal epithelial cell lines. Gly-Gastrin activates the IP-3/AKT pathway. Beta-catenin and Cox-2 levels are increased in cell lines expressing the gastrin gene. We investigated whether these pathways mediate the growth and anti-apoptotic effects of rhPG. Cultured IEC-6 and IEC-18 cells were stimulated 0-15 mins or 24-48h with 0.1-10nM rhPG and analyzed by immunoblots using AKT, IP-3, Cox-2, and Beta-catenin antibodies. rhPG increased the levels of Cox-2 and Beta-catenin in IEC-6 and IEC-18 cells, respectively. rhPG did not show any activation of IP-3 and AKT kinases within 15 mins stimulation of IEC-18 cells. These results suggest that PG stimulates growth of IEC cells via increased levels of Cox-2 and Beta-catenin. Thus, at least three pathways (Cox-2, Wnt and IP3/AKT) mediate the observed biological effects of PG on IEC cells.



Kaneza Biswalo, "Analysis of Microbial Population in a Wetland"

Co-authors: **Tammy Murray** and **Poonam Gulati**

Faculty Sponsor: **Dr. Poonam Gulati**

Project Sponsor: UH-Downtown

The purpose of this research project was to identify bacteria that inhabit the Du Pont Wetlands in La Porte, Texas during different seasons. Samples of bacteria from different locations in the wetland were collected in two different seasons, winter and summer. The samples were identified to species level using standard biochemical tests and rapid ID tests. The results demonstrated that the most abundant genus in the two seasons is *Bacillus*, and the most common organism is *Bacillus cereus*. Organisms such as *Pseudomonas aeruginosa*, which are commonly found in humans, were encountered. This may be due to the fact that many humans frequent the wetlands, including several school groups to conduct different tests. There was some seasonal variation with *Rhodococcus equi*, *Agrobacterium tumefaciens*, *Corynebacterium diphtheriae*, and *Shewanella putrefaciens* present in the winter samples and *Serratia marcescens*, *Paenibacillus macerans* and *Burkholderia cepacia* present in the summer samples. Further testing using ribosomal RNA genes is planned to allow for the detection of ribosomal RNA sequences unique to each species.



Courtney Bock and Caroline Daigle, "Ashwin"

Co-author and Faculty Sponsor: **Dr. Akif Uzman**

Project Sponsor: UH-Downtown

The Ashwin protein became interesting when Sonali Patil discovered that its early induction in the neurulation of *Xenopus laevis* embryos caused them to develop two axes. We are now trying to determine the biochemical function of Ashwin to indicate its role in normal neurulation. To accomplish this task, we have created two mutations of the *Ashwin* gene. One mutant protein lacks a portion of the C terminus and the other lacks a segment of the N terminus. We suspect that the C terminus deletion eliminates a glycosyl-binding domain, which suggests a possible role in DNA binding. The mutations were created using polymerase chain reactions, and the products were then inserted into plasmids. Future steps include transcription of the DNA and injection of the RNA into *Xenopus laevis* embryos. The mutant protein will be synthesized by the embryo during embryonic development, and we will then observe the resultant phenotypes of the tadpoles.



Daniel Brenes, "Effects of Multiple Exposures to UV Light on Polymerized Films"

Co-authors: **Melanie Urdiales** and **Byron Christmas**

Faculty Sponsor: **Dr. Byron Christmas**

Project Sponsor: UH-Downtown Center for Applied Polymer Science Research

An investigation was conducted to determine the characteristics of polymer films made with different photoinitiator (PI) levels and the thermomechanical property changes that occur with multiple exposures to UV light. Polymer films containing 65% by mass acrylated oligomer and 35% by mass acrylated monomer mixture were investigated. These formulations contained either 2.0 pph or 0.5 pph PI, respectively. A UV-Visible Spectrophotometer was used to measure the UV absorption characteristics of the films and dynamic mechanical analysis (DMA) techniques were used to determine the thermomechanical properties of the films. The results indicate, among other things, that multiple exposures of the films to UV light reduces the concentration of PI and apparently increases the crosslink density.

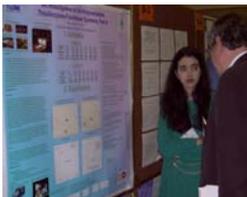


Jannie Dilber, "Effect of Sample Mass/Thickness On Reactivity of UV-Polymerizable Systems"

Faculty Sponsor: **Dr. Byron Christmas**

Project Sponsor: UH-Downtown Center for Applied Polymer Science Research

As an additional study to the research done during the Summer of 2001, which involved the addition of multifunctional thiols to acrylate-functional UV-polymerizable systems, it was decided to investigate the effect of photoinitiator level and relative mass on the relative reactivity of such systems. This was done using a standard formulation containing 65 percent by mass of oligomer and 35 percent total mass of monomers. Jars of standard formulation were made, each containing either 0.5 or 2 pph (parts per hundred) of photoinitiator (PI). Three samples of each of 1.0-5.0 mg, and subsequently, 7.0-11.0 mg +/- 1.0 mg were taken for each of these different formulations and evaluated by DPC experimentation. Results were determined as indicated by the relative reactivity, keeping in mind that a greater reactivity was exhibited by shorter average induction and peak maximum times.

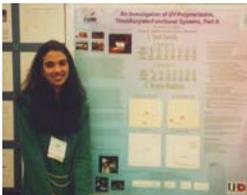


Jannie Dilber, "Effect of Film Thickness, Shutter Time, and Photoinitiator Level On The Relative Reactivity of UV-Polymerizable Formulations"

Faculty Sponsor: **Dr. Byron Christmas**

Project Sponsor: UH-Downtown Center for Applied Polymer Science Research

As a continuation of the work done earlier in the Summer of 2002 to investigate the effect of sample mass/thickness on relative reactivity and total exotherm of UV-polymerizable, thiol-acrylate systems, an investigation was conducted to determine the effects on reactivity of simultaneously varying the shutter time, film thickness, and photoinitiator (PI) level on the reactivity. Using a 23 factorial experimental design, low and high values of photoinitiator level (0.5 and 2 pph (parts per hundred) PI, respectively), shutter time (60 and 90 seconds, respectively), and film thickness (5.0 and 10.0 +/- 1.0 mg, respectively) were created. Each of these three independent variables were combined into eight, five sample experiments and were randomly evaluated by DPC (Differential Photocalorimetry) experimentation. Using a 23 factorial design, the effects of simultaneously varying these three independent variables on the relative reactivity and total exotherm were determined.



Jannie Dilber, "An Investigation of UV-Polymerizable Thiol/Acrylate-Functional Systems, Part A"

Co-author: **Mai Lam**

Faculty Sponsor: **Dr. Byron Christmas**

Project Sponsor: UH-Downtown Center for Applied Polymer Science Research

The standard UV-polymerized formulation, utilized in the CAPSR laboratory in previous investigations, consists of 65% by mass of an acrylated aliphatic urethane oligomer and 35% by mass of a mixture of three acrylate-functional monomers, hexanediol diacrylate (HDODA), isobornyl acrylate (IBOA), and trimethylolpropane triacrylate (TMPTA). In a previous investigation, no consistent data were obtained when different amounts of thiol were added to this UV-polymerizable formulation. In this current investigation, a simpler formulation consisting of only one monomer, HDODA, was utilized. The purpose was to investigate the effects of the addition of thiol on the relative reactivity and shelf-life stability of this simple "model" system when using two different photoinitiator systems. Analysis of the simpler elements of the complex systems may increase our understanding of more complex "models". Results are reported indicating the effect of various thiol concentrations on the relative reactivity and shelf-life stability of two different photoinitiator systems.



Phillip Gallegos, "Motivating Students to Learn with Microbes"

Co-authors: **Susan Stewart, Kaneza Biswalo, and Poonam Gulati**

Faculty Sponsor: **Dr. Poonam Gulati**

Project Sponsor: Clemente Martinez Elementary School, Bellaire Christian Academy and UH-Downtown

A group of UH-Downtown science students visited three schools to introduce microbiology to fifth and eighth grade, primarily minority students. The students conducted lab experiments, visited a university campus, and heard career presentations in microbiology. Student assessments included drawings, questionnaires and discussions. The data suggests that students benefited from having university students in their classrooms. First, they engaged in hands-on lab experiments to collect and analyze data, and to draw conclusions about microbes and the spread of disease. The eighth graders experienced a college environment during their field trip. Finally, the elementary students identified with the primarily minority college students. In a short time the students' understanding of science improved, their misconceptions about diseases and microbes became clear, and their interest level in science increased. This research demonstrates the importance of introducing microbiology to elementary and middle school students, as a valuable tool for enriching the classroom, improving students' understanding and awareness about microbiology, and providing invaluable teaching experience for college students.

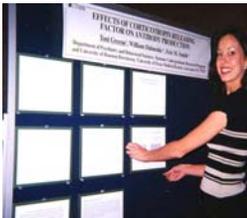


Andrew Gaulden, "NAMPAC – Work Order Database"

Faculty Sponsor: **Dr. Ali Berrached**

Project Sponsor: UH-Downtown

North American Packaging Company (NAMPAC) approached me with a problem concerning their work order tracking system for their production machines. Frankly put, they had none. NAMPAC's current system of work order tracking is a simple paper trail. Work orders are written by hand and filed in a cabinet. NAMPAC would like to be able to track things such as machine down time, employee work time, machine history, work orders, frequency of work orders and other matters of this sort. They would also like to be able to use many different search criteria for each type of query. (EXAMPLE: Search work orders by employee, date, parts replaced, area of plant the machine is located in, and many others.) My project is the design and implementation of a maintenance database for NAMPAC's plastics manufacturing plant in Bryan, TX. This database will be implemented using Microsoft ACCESS and placed on NAMPAC's current Sequel Server 6.5.



Toni Greene, "Effects of Corticotropin Releasing Factor on Antibody Production"
Co-authors: **William Dalmeida** and **Eric Smith**
Faculty Sponsor: **Dr. Joan Abramowitz**
Project Sponsor: University of Texas Medical Branch, Galveston

Corticotropin and endorphins are known to be immunosuppressive *in vitro*. However, CRF stimulates immune functions, and preliminary data shows enhancement of antibody producing cells. Preliminary testing formed an ELISA to specifically detect mouse IgM against the protein antigen KLH. The ELISA utilized KLH to bind a series of primary and secondary antibodies conjugated with alkaline phosphatase. A standard curve was generated resulting in a detectable range of 12.5 to 0.05 ng/ml of IgM. The initial PFC assay confirmed that CRF enhances the number of antibody producing cells. The ELISA is currently being compared to PFC assays to confirm that CRF enhances both the quantity of antibody producing cells and the amount of antibodies being produced.



Daniel Haddock, "Zeoionics as a Substrate for Biomass Production in Space"
Co-authors: **D. W. Ming**, **C. Galindo**, **J. E. Gruener**, **D. C. Golden**, and **Penny Morris-Smith**
Faculty Sponsor: **Dr. Penny Morris-Smith**
Project Sponsor: NASA - Johnson Space Center

The ability to grow plants in space will help to eliminate oxygen and food supply as factors which place constraints on the duration of space missions. NASA has conducted experiments to prove that a photosynthesizing biomass of sufficient size is able to produce enough oxygen to support life in a closed loop system. In fact, there exists a cycle of regeneration between the biomass and the crew that would theoretically provide a long-term supply of oxygen and food. For the past decade and a half NASA has been refining a zeoionic plant-growth substrate which will make long-term biomass production in space possible. The zeoionic substrate is composed of four components that work together to slowly release all of the essential nutrients required for plant growth. These components are ammonium-exchanged clinoptilolite (Cp) (NH₄-Cp), potassium-exchanged clinoptilolite (K-Cp), nutrient-substituted synthetic hydroxyapatite (NHA), and naturally occurring dolomite. My proposed research conference talk will be an overview of the basic theory behind the substrate, and will identify which plant essential nutrients are supplied by each of the four components of the zeoionic substrate.



Hafid Hernandez, "The Stability and Relative Reactivity of Urethane/Epoxy Acrylate-based Systems Containing a Thiol-functional Monomer"
Faculty Sponsor: **Dr. Byron Christmas**
Project Sponsor: UH-Downtown UH-Downtown Center for Applied Polymer Science Research

Following work of Mr. Huy Ho entitled "Reactivity and Thermomechanical Properties of UV-polymerizable Formulations Containing a Thiol-functional Monomer", part of the focus of the current project is on reactivity and shelf life of "model" formulations with varying amounts of tri-functional thiol monomer. The "model" formulation contains 65% oligomer and 35% monomer. The prepared formulations differed in the relative amount of urethane oligomer. The first formulation contained only urethane, another contained 50/50 urethane and an acrylated epoxy, and the third formulation contained 100% epoxy. Another objective of this project was to evaluate the relative reactivity of formulations containing equimolar amounts of thiol and acrylate functionalities. Differential photocalorimetry (DPC) was used to measure the reactivity of each formulation. Results are presented showing the effects on reactivity of the epoxy/urethane oligomer ratio and the level of thiol when used in equimolar amounts with the acrylate functionality.



Victor Kaiser, "Decision Support Tools in Clinical Decision-making: A Preview to Research"

Faculty Sponsor: **Dr. Ermelinda DeLaVina**

Project Sponsor: UH-Downtown

As the quantity of health-related information grows exponentially, the methods for acquiring, storing, and using that information must develop at an even or greater pace. Researchers in Medical Informatics are investigating many of the solutions to these problems. In this preview to research, the presenter defines Health Informatics as a discipline, especially as it relates to Bioinformatics. Various disciplines within Health Informatics are identified and a number of applications within these disciplines is briefly discussed. As a preview to further research by the presenter, the need for decision support tools in clinical decision-making and the impact these tools may have on patient safety, cost reduction, and improved standards in clinical practice are presented.



Jeeba Kuriakose, "Characterization of Soil Fungi Based on rDNA Sequence Variation"

Faculty Sponsor: **Dr. Phil Lyons**

Project Sponsor: UH-Downtown, Plant and Seed Technology Lab

The purpose of this research was to determine whether rDNA sequence variation is useful for characterizing soil fungi diversity. Initial screening of *Trichoderma* sp. and *Fusarium* sp. isolates collected from agricultural and forest soils within Sheldon Lake State Park indicated an ITS1F/ITS4 fungal PCR primer set was effective in amplifying fungal rDNA. More extensive PCR analysis with these primers was conducted on 24 isolates representing at least six different species of each of the two fungal genera. Results indicated that sequence variation among fungal rDNA's should be useful for distinguishing *Trichoderma*, *Fusarium* and other genera of soil fungi, and may also be helpful in distinguishing fungal isolates at the species level. We are now attempting to profile soil fungi populations by sequencing cloned PCR products amplified directly from soil DNA, and by terminal RFLP (TRFLP) analysis of amplified soil fungal rDNA's to distinguish sequences based on differences in fragment length.



Mai Lam, "An Investigation of UV-Polymerizable, Thiol/Acrylate-Functional Systems, Part 2"

Co-author: **Jannie Dilber**

Faculty Sponsor: **Dr. Byron Christmas**

Project Sponsor: UH-Downtown Center for Applied Polymer Science Research

An investigation of the relative reactivity and shelf-life stability of relatively simple UV-polymerizable systems was begun during the Summer of 2002. These simple model systems contained a 50/50 by mass mixture of the difunctional acrylate monomer, 1,6-hexanediol diacrylate (HDODA), and the monofunctional acrylate monomer, isobornyl acrylate (IBOA). They also contained photoinitiator (PI) or a photosensitizer (PS) and varying levels of trimethylolpropane *tris*-(3-mercaptopropionate), a trifunctional thiol. This study was a continuation of previous work designed to evaluate the effects of thiol-functional monomers on the properties of more complicated acrylate-based UV-polymerizable formulations. Using Differential Photocalorimetry (DPC) techniques, samples of each formulation were examined for their relative reactivity. Shelf stability of the different formulations was determined by observing the time required for samples of each formulation to form a gel in their respective containers.



Diana Leal, "Infection of the Roots of Wild Grape Vines (*Vitis candicans*) by Arbuscular Mycorrhizal Fungi."

Faculty Sponsor: **Dr. Lisa Morano**

Project Sponsor: UH-Downtown

Mycorrhizae are mutualistic associations between beneficial soil fungi and plant roots. Symbiotic mycorrhizae (fungi root interactions) were identified in root samples of wild grapevines, *Vitis candicans*. Arbuscular mycorrhizae (AM) were shown to colonize roots with hyphae, vesicles and arbuscules ("tree-like" structures where nutrient exchange occurs). Three samples of 100 roots were investigated at four sites using the root intersection method on microscope slides. About 80% of roots, on average, contained mycorrhizal fungi and between 27 and 50% of roots contained vesicles. Arbuscules were located in about 1% of colonizations. Soil physical texture was determined at each of the four sites and there was a significant difference in vesicle numbers for the four sites with the sandiest soil site having the statistically lowest vesicle percentage and observably lower overall mycorrhizal colonization. A significant mycorrhizal soil interaction for *V. candicans* demonstrates the complexity of rhizosphere ecology.



Shazia Malik and Imran Malik, "Analysis of Mycorrhizal Infection Levels in Four Different Soil Environments at Sheldon Lake State Park"

Co-author and Faculty Sponsor: **Dr. Lisa Morano**

Project Sponsor: UH-Downtown

Mycorrhizae are the symbiotic relationship between plant roots and soil fungi. The mycorrhizal infection levels of four soils environments were compared at Sheldon Lake State Park as part of a long-term project to study soil and plant community changes. Replicated samples of soils from agricultural field, mima mounds within the field, agricultural field along forest and forest were all evaluated for soil texture. Analysis of variance for soil data revealed that mima soils had significantly more sand ($p = 0.025$). Corn plants grown in the different soils then served as a bioassay to estimate mycorrhizal infection potential of the different soil environments. Corn roots were stained and 100 root intersections from each of 96 pots were evaluated for hyphae, vesicles, and arbuscules. Forest soils produced corn with higher average % hyphae and arbuscules. This suggests that mycorrhizal levels may be higher in the forest soils at Sheldon Lake State Park.



Teresa Martinez, "Solvent Extraction and Analyses of Non-Crosslinked Components of UV-Polymerized Films"

Co-authors: **Melanie Urdiales and Vedangi Sample**

Faculty Sponsor: **Dr. Byron Christmas**

Project Sponsor: UH-Downtown Center for Applied Polymer Science Research

A study was conducted to determine the type of components that can be removed from UV- polymerized films made with varying peak irradiance and UV dose. Through an initial optimization experiment, the best conditions for optimizing the HPLC/GPC system were determined to be a GPC sensitivity of eight, 35°C temperature, 0.2 mL/min flow rate, and 500 μ L injection volume. A 2⁴ factorial design was completed for this set of data to aid in determining the optimized values and gave the highest values at the listed conditions. With these data it was easier to determine the effects of peak irradiance and UV-dose on the amount and type of extractables. Calibration curves for each component were developed and were followed by actual data collection. The experiments overall showed that as the UV dose decreased, the amount of extractables increased and as the peak irradiance decreased, the amount of extractables slightly increased.



Christopher McIntyre and Josh Keele, "Math Drill Game"

Faculty Sponsor: **Dr. Richard Aló**

Project Sponsor: UH-Downtown

Over the past few years there has been an alarming trend in students becoming dependent on computational machinery for the solutions to simple math problems. Our goal was to design a drill software to improve the basic math skills of the user and thereby eliminate dependence on a calculator for such problems. In order to accomplish this task, we utilized the RAD language VB and Macromedia's Flash Component. The software was beta tested this past summer by students in the Houston PREP program in S735, and statistical data was collected. We are currently modifying the program to include more difficulty levels and functionality, and plan to implement a server/client version in the near future, for the purpose of collecting more data.



Guadalupe Quiroz, "Courtship Behavior and Mate Choice of the Male Lizard *Anolis carolinensis* Based on Visual and Olfactory Familiarity"

Faculty Sponsor: **Dr. George Farnsworth**

Project Sponsor: UH-Downtown

Males in polygynous mating systems may prefer to mate with unfamiliar females than with familiar females as a strategy to increase their reproductive success. This has been demonstrated in experiments with lizards in the genus *Anolis*. I designed an experimental test using the lizard *Anolis carolinensis* to determine if only visual and olfactory contact of males with females would lead to mate choice based on their familiarity. Males and females were collected from different places to avoid previous contact between them. Lizards were placed in cages that had a screen dividing them into two compartments. Two females were in one side of the cage and one male was in the other. On the test day, the barrier was removed and the lizards were allowed to have physical contact. I concluded that *Anolis carolinensis* males do not base their mate choice on visual and olfactory familiarity with females under laboratory conditions.



Laura Salazar, "Independence Number of the Second Power of Connected at Most Cubic Graphs"

Faculty Sponsor: **Dr. Ermelinda DeLaVina**

Project Sponsor: UH-Downtown

One aspect of my senior project involves the resolution of conjectures generated by the computer program, Graffiti.pc. My project advisor, Dr. Ermelinda DeLaViña, wrote the program. My presentation includes a description of the program, a chronology of interactions with the program, and my mathematical results, thus far, on conjectures relating to the graph invariant called the *independence number of the second power of connected at most cubic graphs*. The *independence number* of a graph is the cardinality of a largest subset of the vertices of the graph, such that no two vertices in the subset are adjacent. An *at most cubic graph* is a graph in which the maximum degree is at most three. The *second power* of a graph G is the graph on vertex set $V(G)$, such that vertices v and u are adjacent if and only if they are at distance of at most two in G .



Zahra Salehpoor, "Finding the Path Covering Number of a Graph Using Graffiti.pc"
Faculty Sponsor: **Dr. Ermelinda DeLaVina**
Project Sponsor: UH-Downtown

Using the computer program Graffiti.pc, a conjecture making program designed by Dr. Ermelinda DeLaVina, my project consists of finding the path covering number for a special type of tree. A collection of pairwise vertex disjoint paths that cover all vertices of a graph G is called a path covering of the graph G . The size of a smallest path covering will be called the path covering number of G . The idea of the path covering number of a graph is a generalization of the well-known mathematics problem, known as the Traveling Salesman Problem. This presentation is a summary of my results thus far, with an emphasis on the rules utilized, which we call the Red Burton rules.



Vedangi Sample, "Measuring the Isotopic Enrichment of L-Alanine in the Form of its n-Heptafluorobutyric Anhydride Derivative Using the Negative Chemical Ionization Mode on the Gas-Chromatograph and Mass Spectrometer"
Faculty Sponsor: **Dr. Byron Christmas**

The purpose of my research project was to establish a method to measure the isotopic enrichment of alanine labeled with two different isotopes ^{13}C and ^{15}N and determine if they could be analyzed simultaneously using the negative chemical ionization mode (NCI) on the GC/MS. Alanine was prepared as the n-heptafluorobutyric anhydride (HFBA) derivative. The molecular formula of this derivative was $\text{C}_{10}\text{H}_{12}\text{NO}_3\text{F}_7$. The study consisted of five different standards having the ^{13}C and ^{15}N label and varied isotopic enrichments. On the GC/MS, the peaks monitored were 239-242 and 307-310. The peaks 307-310 contained the whole alanine derivative without hydrogen and a fluorine atom. The second range of peaks 239-242 contained only a fragment of the whole molecule by the loss of the propyl ester fragment and a hydrogen ion. This fragment included the nitrogen atom of the original alanine molecule but not its first carbon. The results obtained from the chromatograms indicate that the HFBA derivative and the NCI mode could be used to simultaneously determine the isotopic enrichments of the ^{15}N and the ^{13}C L-alanine.



Shakti Sharma and Mai Vo, "Thermomechanical Properties vs. Depth of Cure for UV-Polymerized Films"
Co-author and Faculty Sponsor: **Dr. Byron Christmas**
Project Sponsor: UH-Downtown Center for Applied Polymer Science Research

Jönsson, et. al., refer to a property known as "absorbed light intensity", I_a , in several technical papers. This absorbed intensity is the product of the incident light intensity, I_0 , and the molar concentration of photoinitiator, $[\text{PI}]$. If I_0 is raised while the $[\text{PI}]$ is proportionally lowered, then I_a should remain constant and the properties of the resulting polymer films should also remain constant. This project was designed to follow up on Jönsson's work to see if the absorbed intensity concept can be corroborated for the thermomechanical properties of UV-polymerized films. Dynamic mechanical analysis (DMA) techniques were used to determine the storage and loss moduli of the polymer films and their corresponding $\tan \delta$'s over the temperature range of -130°C to 130°C . Comparisons are made among the various films to determine whether or not samples cured at constant I_a have the same thermomechanical properties at different peak irradiance and/or photoinitiator levels.



Susan Stewart, "Lepidoptera Diversity of Southeast Texas"

Faculty Sponsor: **Dr. Jeffrey Flosi**

Project Sponsor: UH-Downtown Medical Entomology Lab & Urban Science and Ecology Summer Internship Program

The species diversity of southeast Texas Lepidoptera (butterflies and moths) was estimated by comparing species in a twenty county area over a six-month period. The purpose of this informal survey, conducted from September 2000 to April 2001, was to monitor diversity of butterflies and moths found in areas representing a variety of climates and geographical areas in southeast Texas. Species populations were expected to peak from February to April, and again in late June to August. At the end of this survey, 117 (79%) of known butterfly, and 28 (9.3%) of the 300 moth species were identified. This data shows that the Lepidoptera populations in southeast Texas are diverse, and diversity may be due to the availability of plant food, temperature, and climate in a geographical area.



Meng Tian, Fanny Cardenas, and Obadiah Kegege, "Magnetic Levitation System"

Faculty Sponsor: **Dr. Weining Feng**

Project Sponsor: UH-Downtown

The main objective of this maglev project is the focus on research and the implementation of magnetic suspension systems. Avoiding mechanical friction is an important issue in many mechanical devices ranging from small laboratory equipment to public transportation systems and magnetic levitation is an effective solution to this kind of problem. In this Magnetic Levitation (maglev) project, we are trying to demonstrate a classic feedback control system with analog proportional-derivative controller design. The magnetic force generated by an electromagnet counteracts against gravity force, and the electromagnetic force is controlled by varying electric current to the electromagnet which suspends an object. Using an infra-red sensor, the output of the detection stage yields high-precision measurements of the fluctuations in the vertical position of the device and the current fed to the electromagnet provides a precise reading of the vertical force felt by the levitating part.