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Science Missions for a Mercury Orbiter

Danielle L. Timmons and Harold L Chambers II, Department of Physics & Astronomy

Practically all of our knowledge of the planet Mercury comes from the Mariner 10 fly-bys in 1974-1975 which imaged 45% of the planet's surface. We propose an orbiter mission to Mercury to completely map its surface. Consideration is given to additional science objectives in order to maximize the science return on mission investment. Several design parameters for the orbiter and cost of the mission are also estimated.

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Prey detection and the use of mucus in prey capture by the ctenophore Mnemiopsis leidy A. Agassiz, 1865

Scott S. Lloyd, Department of Biology

These experiments studied the chemical detection of prey by Mnemiopsis leidy and the possible toxicity of its mucus, for both would be greatly advantageous for prey capture. The data show that M. leidy can indeed chemically detect Artemia nauplii in Artemia-conditioned seawater. This chemical detection resulted in ctenophore activity levels 10 times the activity levels of the ctenophores in unconditioned seawater. Regarding prey capture, the data show that the mucus of M. leidy has no toxic component or that any toxic component present is not easily soluble in seawater. Apparently, the mucus is used primarily to physically capture prey.

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Naphtho[1,8 bc]pyran-2(3H)-one Preparations

Jill Butler, Department of Chemistry and Biochemistry

The lactone, naphtho[1,8 bc]pyran-2(3H)-one, has been made by two different routes as reported in the literature. One route utilizes a problematic Baeyer-Villiger reaction of the readily available ketone, acenapthlenone. Another is a cumbersome, multiple step approach that begins with the compound, 1,8-naphtholactone. We will report on our progress to develop a simpler approach from the readily available isomeric lactone, 1H, 3H-naphthol[1,8 cd]pyran-1-one (1,8)naphthalide.
An Application of Recurrence Relations to Problem 10622, AMM

Jim Bowring, Department of Mathematics

A question posed in the American Mathematical Monthly vol. 104.9 (Nov, 1997) asks to find an infinite set of triples \((a,b,c)\) of integers where \(a,b,c\) are in arithmetical progression and \(ab+1, ac+1, bc+1\) are perfect squares. Two such infinite sets are obtained using recurrence relations and algebraic manipulations.

The Role of the Ets2 Transcription Factor in Cellular Differentiation and Proliferation

Leilani Lee, Department of Biology

By looking at two cell lines, PC12 and P19, transfected with different levels of the Ets2 gene, one can observe changes in the phenotype of cells due to the misexpression of the Ets2 transcription factor. Via a proliferation essay, it was determined that the increased levels of Ets2 led to a decrease in proliferation. Changes in the morphology to the cells were also seen as a result of misexpression of the Ets2 gene. Long extensions resembling axons and dendrites were seen on both the P19 and PC12 sense cells. By the use of immunohistochemistry, these long extensions were identified as vimentin intermediate filaments and not neurons. Also, high levels of muscle protein were seen in the P19 and PC12 sense cells. The PC12 sense cells showed premature development of cardiac muscle too. The premature differentiation of cells could be a cause of the abnormalities seen in patients with DS.

3-Dimensional Hyperspectral Geologic Mapping of Borate minerals in Furnace Creek, Death Valley

Erik van der Horst and Steven V. Stearns, Department of Geology

Airborne Visible Infrared Imaging Spectrometer (AVIRIS) data acquired in 1995 were used to map Tertiary playa lake deposits in the Furnace Creek area of Death Valley, California. The geology of the Furnace Creek area includes limestone, sandstone, shale and volcanic units. Most of the borate deposits are concentrated in the Furnace Creek Formation, which is composed of intermixed fine grained playa deposits and coarser river sediment deposits. While the spatial resolution of AVIRIS hyperspectral data is 17 meters, most of the Borate minerals are found as thin veins intimately intermixed with other lithologies. Advanced n-dimensional analysis of the AVIRIS scene allowed for identification of borate minerals outcrops, which were much smaller than the 17 meter resolution of the spectral data. Sub-pixel analysis of borate minerals were made possible by comparison of library borate minerals spectra with spectra derived from the AVIRIS scene. In the future, research of this type will allow cutting edge detection and mapping of mineral deposits in previously inaccessible field areas. This research was made possible by NASA / JOVE and the South Carolina Space Grant Consortium.
**Distribution and Characterization of Angiotensin-Converting Enzyme-Like Activity in Tissues of the horseshoe crab, *Limulus polyphemus***

Georgina D. Gainey, M.T. Doig and J.W. Smiley, Department of Biology

Angiotensin Converting Enzyme-Like activity (ACE) was located in the tissues of the horseshoe crab, *Limulus polyphemus*. The presence of ACE was determined using an HPLC analysis and the substrate N-(3-[2-furyl]acryloyl)-phenylalanylglycylglycine (FAPGG). The enzyme had a $V_{\text{max}}$ of 148.4 nm FAP/min and a $K_M$ value of 1.9uM. The greatest amount of activity was found in the digestive gland (78.9 nm FAP/min/mg protein) with lesser amounts in heart, blood and gill. Complete inhibition of the activity was seen using Captopril and Lisinopril with IC$_{50}$ values of 2.39 x 10$^{-7}$ M and 2.16 X 10$^{-7}$ M respectively. ACE activity was not inhibited by Phosphoramidon (1 x 10$^{-4}$ M) and was only partially inhibited by Leupeptin (6.5 x 10$^{-4}$ M). The enzyme was determined to be soluble with 99.2% of its activity in the supernatant.

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**The Effects of Terrain and Albedo Modeling on the Martian Polar Caps and Pressure Distribution**

Douglas Christiansen and B. Lee Lindner
Department of Physics & Astronomy

The effects of albedo and terrain have been studied with their relevance to the Martian polar caps. While we can measure the size of the caps from earth with respect to seasonal girth we have little physical evidence regarding the cap thickness and life cycles. The Viking lander data gives us information from which a computer model can be built to test the caps empirically. The albedo and terrain variables will be shown to correlate with, and justify, the Viking pressure data as well as meet observed limits of polar cap formations with the model of the polar caps.

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**A Web-Based Personal Teaching Portfolio (PTP)**

Dee Smith, Team Ogam of CS 461, Computer Science Department

The Teaching Portfolio at most educational institutions is a collection of the teacher's educational philosophy, examples of the teacher's work in the classroom and the research field, and examples of their service to the college and community. The portfolio in paper format becomes large and cumbersome and difficult to maintain and distribute. A solution to this problem was to create a web-based portfolio creator and viewer. All of the materials originally collected and placed in the bound portfolio may be represented on the World Wide Web in a digital fashion. The fact that creation is web-based allows for access and maintenance of the portfolio from virtually any computer in the world that has Internet access. This solution was created by a five-person software engineering team using the waterfall development model. A client-server system was designed and developed to fulfill the requirements specified by the client, a professor at the College of Charleston. The work was done in four phases in accordance with the waterfall model - requirements gathering, design, development and testing, and maintenance.
An almost unspoken assumption of physics since the time of Newton is that simple behavior would be described by simple equations and complicated behavior by complicated equations. Beginning in the late 1800's with Henri Poincare and then with Ed Lorenz in the 1960's, we have come to realize that some surprisingly simple descriptive equations have parameter values that lead to behavior so complicated as to appear completely random. The term used to describe this surprising result is called "chaos." If we knew that some behavior which appeared random was only chaotic, we would have hope that a very simple order lay underneath. There is a theorem, called Taken's theorem, which describes a technique for extracting an estimate of the number of controlling variables from a time series of data which appears random. The technique works even when the descriptive equations are completely unknown. This paper will report on the result of applying Taken's technique to EKG data of regular

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Contact Light: Interactive CD-ROM Edutainment

Amer Smailbegovic, Cassandra Coombs, Nafees BinZafar, and Jason Ward
Department of Geology

Place yourself in the year 2005: we have succeeded in launching the International Space Station and are using it to stage our return to the Moon. The first International Lunar Outpost has been established on the Aristarchus Plateau and the Moon has become a new territory for research, development and education. The USS Contact Light has volunteered its ship and crew to host a group of students explore the moon. After familiarizing themselves with the main concepts of lunar geologic history and exploration while on Earth, the students are now ready to visit the Moon. The students are set to explore five different sites: lunar highlands, maria, South Pole, crater Tycho and Aristarchus Plateau. They will be able to wander around the various sites either on foot or by lunar rover, collect samples, take notes and analyze lunar rocks. However, from time to time they will have to stop by the lunar outpost for resupply with fuel and air. While at the lunar outpost, the students will have a chance to talk with the outpost's personnel, visit the facilities and learn what it will take to live on the moon.

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Reduced Gravity Lava Flow Experiment

Jeff Nettles, Amer Smailbegovic, and Cassandra Coombs
Department of Geology

Quiescent eruptions on Earth occur when lava emerges from the vent without explosive force. Upon eruption, lava begins to flow downslope forming a thin crust as it quickly loses the heat at the top of the flow. The same kind of eruption might occur very differently on a planet with weaker gravity.

Common sense suggests that the lava would be able to travel further, and would likely splash on many sides of the mountain. However, these are just assumptions. Scientists have not been able to study an entire eruption of a volcano on an extraterrestrial body. Eruptions either occurred long ago or are simply not in view of the entire eruption because of the rotation of planetary bodies. The main goal of our experiment is to finally offer some data on the dynamics of an entire eruption event as it might occur on an extraterrestrial body.
We used a relatively simple model of a shield volcano, with simulants of quick-cooling lava, to emulate these quiescent eruptions under reduced gravity conditions aboard NASA's KC-135 airplane. The simulated eruptions were videotaped and compared with those in the Earth-gravity environment.

As expected, lava from our simulated eruptions did travel upward further than would be expected on Earth. Also, the surface tension of the lava simulants kept them from spreading out radially while in the air to the degree that occurs on Earth. This suggests that eruptions on the Moon shot lava upward essentially in a ball, then that ball fell back to the lunar surface, spreading out only upon impact. Our next task is to examine imagery from the Moon and other planetary bodies to try to determine if this might be what actually happened on those bodies.

Immunofluorescent Evidence for the Presence of the Platelet-Activating Factor Receptor on Spermatozoa, Oocytes and Preimplantation Embryos

Alison Taub, Biology Department

Platelet-activating factor [1-O-alkyl-2-acetyl-sn-glycero-3-phosphocholine; PAF] is a potent signaling phospholipid which has pleiotropic biological properties in addition to platelet activation. PAF plays a significant role in gamete interaction, being required for spermatozoal motility and fertilization. PAF also plays a significant role during preimplantation embryo development. PAF's signal transduction mechanism, in other cell types, is receptor-mediated. However, the presence of this receptor in spermatozoa, oocytes and embryos has not been confirmed. Therefore, the study objective was to determine the presence of the PAF-receptor in mouse spermatozoa, oocytes and embryos by immunofluorescence analysis. All cells were treated with rabbit preserum (control) or PAF-receptor antibody at 4°C. Following a 60 min treatment period, the cells were washed in PBS then exposed to FITC-conjugated antirabbit IgG for 10 min at 4°C, and again washed in PBS. Immunofluorescent microscopy was performed on a Zeiss Axioplan microscope equipped with an epifluorescence filter attached to a Dell OptiPlex GXPro with Image-Pro Plus 3.0 computer system. The presence of the PAF-receptor in all cell types was confirmed by immunofluorescent microscopy. The PAF-receptor was found to be localized on the spermatozoa, with highest fluorescence on the midpiece region. PAF-receptor expression was uniform in oocytes and throughout the preimplantation embryonic period.

G Protein Purification From Bovine Brain and Preliminary Test for Developing a Fluorometric Assay For Monitoring Alpha to Beta-Gamma Interactions of G Protein

Alap R. Jani, Chemistry and Biochemistry Dept. and J. Hilderbrandt, Dept. of Cell and Molecular Pharmacology, MUSC

There are many cell membrane bound receptors that employ G (for GTP binding) proteins to initiate intracellular signalling chain reactions which guide a cell's actions. These chain reactions allow a relatively small hormonal signal to be greatly amplified, causing massive intracellular changes. Thus, receptors that control G proteins are often the targets of drugs. Current methods only allow the study of G proteins in solution, after they have been purified and extracted from their native cellular environment. The project proposed here is ultimately concerned with studying the activation of the G protein mechanism in intact membranes and cells. The approach for studying G protein activation inside the cytosolic environment is based upon using fluorescently labeled peptides to monitor G protein subunit interactions.
A Study Of Plant Distribution Changes In Abandoned Rice Fields Within Freshwater Estuaries In Georgetown Co., South Carolina

D. Alsup and C. Coombs, Department of Geology

Spatial changes in plant population distribution over time are being analyzed using remote sensing and Geographical Information Systems (GIS). Fieldwork is comprised of community characterization and attribute data collection from the period of May 1997 through June 1998 using a centerpoint-quadrat method along transects through rice islands. Information gathered from this sampling method yields community abundance, dominance, and frequency of species in plant communities; as well as speciation and canopy height of the following plant types: tree, shrub, herb, and grass. Percent cover of the dominant species was also estimated for each plant type. Remote sensing analysis includes an unsupervised classification of a 1994 National Aerial Photography Program (NAPP) photo of the Brookgreen quadrangle. The differences in classes were extrapolated to show differences in canopy height of trees, shrubs, herbs, and grasses. Differences between areas in different successional stages are evident. Preliminary statistical results support trends found in the unsupervised classification. These data will be georectified using a 1990 SPOT Panchromatic image.

A Novel Approach to Design Artificial Gene Repressors for Cancer Therapy

Daniel Pacheco, Department of Biology

Triplex-forming oligonucleotides (TFOs), that bind in a sequence-specific manner to DNA, can be used to target selected sites in the regulatory or coding region of a gene. The resulting triplex structure has the potential to prevent the expression of the targeted gene. This strategy has potential therapeutic application in cancers where the expression of oncogenes is often deregulated. We have determined the ability of the triplex DNA approach to regulate the expression of the \textit{c-myc} oncogene and inhibit the growth of human leukemia cells in culture. A series of phosphodiester and phosphorothioate TFOs targeted to distinct sites near the promoter and coding region of the \textit{c-myc} gene were designed. Our results show that TFOs targeted to the P2 promoter effectively inhibit \textit{c-myc} gene expression and proliferation of leukemia cells in culture.

A New Series of Exited State Proton Transfer Molecules; Ortho-Hydroxyphenylpyrazoles

Mary E Rampey, Aseem Sood, Shannon L. Studer-Martinez, Charles F. Beam
Dept of Chemistry and Biochemistry

Substituted ortho-hydroxyphenylpyrazoles were prepared using strong base synthesis techniques employing multiple anion type intermediates. The pyrazoles have shown promise as a new series of excited state proton transfer molecules. Initial fluorescence spectra in hexanes show a maximum at 328 nm due to the normal species and a stokes shifted maximum at 620 nm which is tentatively assigned to the tautomer species. In order to confidently attribute the long wavelength band to excited state proton transfer, the ortho-hydroxy substituent has been methylated. Studies have also been performed to investigate the effects of substituents and solvent polarity on the photophysics of the new pyrazoles.
Reactivity of Fluorosilyl Adsorbates

Bryce Donovan, Mark Kaldas and Kristin D. Krantzman
Department of Chemistry and Biochemistry

Experimental and theoretical work on silicon-fluorine etching has shown that steady-state etching occurs between incoming fluorine atoms and a reactive fluorosilyl layer. This layer is thought to be composed of tower-like adspecies of SiF, SiF$_2$ and SiF$_3$ groups. Previously, molecular dynamics simulations of the reaction between gaseous fluorine atoms and SiF$_3$, SiF$_2$-SiF$_3$ and SiF$_2$-SiF$_2$-SiF$_3$ on the Si(100)-(2x1) surface have been performed in order to determine the composition, mechanism of formation and energy distribution of the etched products. This paper describes similar simulations between incoming fluorine atoms and SiF-SiF$_3$, SiF-SiF$_2$-SiF$_3$ and SiF-SiF-SiF$_3$ adsorbates. The primary product of these reactions is SiF$_4$. No adsorption of the incoming fluorine atom to the adsorbate is observed. The reaction cross section, defined as the product of the surface area available to the incoming fluorine atom with the reaction probability, is a measure of the reactivity of the adsorbate. The simulations show that the reactivity with gaseous fluorine atoms increases as the length of the fluorosilyl adsorbate increases. The results are compared to experimental data on silicon-fluorine etching.

Molecular Dynamics Simulations of Organic SIMS with Cu$_n$ (n=1,4) Projectiles

Jennifer Townes, Radomir Zaric, and Kristin D. Krantzman
Department of Chemistry and Biochemistry

Barbara J. Garrison, Department of Chemistry, Penn State University, University Park, PA

Secondary Ion Mass Spectrometry (SIMS) can be used to identify molecular solids on surfaces such as pesticide residues on soil. Experiments have shown that cluster projectiles as compared to atomic projectiles enhance the secondary ion emission of organic molecules, and therefore, can increase the sensitivity of SIMS. We describe molecular dynamic simulations aimed at understanding how the emission yield depends on the number of atoms in primary projectile. Our model system, a monolayer of biphenyl molecules adsorbed on a Cu(001) surface, is chosen as a prototype of the experimental systems of interest. Cu atoms and Cu$_n$ clusters with n = 2 to 4 and kinetic energies from 0.100 to 0.250 keV per atom are brought in at 90 degrees incidence. The emission yield and the surface damage is determined as a function of incident kinetic energy and the binding energy of the biphenyl adsorbate.

Using Molecular Dynamics Simulations to Model SIMS Experiments: Comparing Ar, Xe and SF$_5$ as the Bombarding Particles

Elizabeth W. Smith and Kristin D. Krantzman
Department of Chemistry and Biochemistry

Barbara J. Garrison, Department of Chemistry, The Pennsylvania State University, University Park, PA
Previous experiments have demonstrated that cluster projectiles as opposed to atomic projectiles enhance the secondary ion emission of organic molecules. The yield depends nonlinearly on the number of constituent atoms in the primary ion cluster. We performed molecular dynamics simulations to explore how the yield and the surface damage depend on the nature and incident energy of the bombarding particle. Ar and Xe were chosen as primary particles to determine the effect of mass alone on secondary ion emission since they behave similarly. SF$_5$, which has the same mass as Xe, was used to determine the effect of the number of atoms in the cluster. The emission yield and surface damage were determined as a function of the primary ions used. The effect of the binding energy of the biphenyl molecule on the emission yield was also examined.

**Zoom in! Silicon Etching via Fluorine Atoms: Is there a pattern?**

Mark Kaldas, Bryce Donovan and Kristin D. Krantzman  
Department of Chemistry and Biochemistry  

Experimental and theoretical work on silicon-fluorine etching has shown that steady-state etching occurs between incoming fluorine atoms and a reactive fluoro-silyl layer. This layer is thought to be composed of tower-like adspecies of SiF, SiF$_2$ and SiF$_3$ groups. Previously, molecular dynamics simulations of the reaction between gaseous fluorine atoms and SiF$_3$, SiF$_2$-SiF$_3$ and SiF$_2$-SiF$_2$-SiF$_3$ on the Si(100)-(2x1) surface have been performed in order to determine the composition, mechanism of formation and energy distribution of the etched products. This paper describes similar simulations between incoming fluorine atoms and SiF-SiF$_3$, SiF-SiF$_2$-SiF$_3$ and SiF-SiF-SiF$_3$ adsorbates. The fluorine atom is brought in at normal incidence at a randomly selected impact point. The results are averaged over a set of 500 trajectories for incident kinetic energies of 2.0 eV, 3.0 eV and 5.0 eV. The purpose of the simulations is to compare the overall reactivity of each of the adsorbate species and to determine any patterns seen in the results. The reaction probability increases with the incident kinetic energy of the incoming fluorine atom and with the length of the fluoro-silyl adsorbate.

**Evaluation of the in situ Degradation Patterns of a TCE Plume at Charleston AFB, SC**

Anne-Marie G. Hasstedt  
Masters of Environmental Studies Program  

Contaminant transport or migration is primarily governed by advection, dispersion, and degradation. The objective of this investigation is to graphically evaluate the in situ degradation patterns of trichloroethene (TCE) at a site in Zone 4 of Charleston Air Force Base (CAFB). TCE is a chlorinated aliphatic compound that is among the most commonly observed contaminants found in shallow groundwater systems. It is a solvent historically used in dry cleaning and metal degreasing. The plume located on CAFB is potentially the result of former washrack operations. The prevalence of TCE probably results from its widespread use and earlier lax disposal practices. TCE is denser than water, which can result in downward free-phase flow. TCE is also somewhat water-soluble (1,100 mg/L at 25°C), which enables advective transport. In addition, it is resistant to microbial degradation under aerobic conditions commonly found in shallow groundwater systems. Since it is used as a solvent, it is often accompanied by other contaminants such as petroleum hydrocarbons (BTEX compounds) or metals. BTEX compounds are readily degraded by aerobic bacteria. Therefore, their presence can create an anaerobic environment leading to the reductive dehalogenation of TCE. In reductive dehalogenation chlorinated hydrocarbons serve as an electron acceptor, and chloride ions
are removed in succession. The degradation products of this dehalogenation are more susceptible to aerobic oxidation than TCE itself (Chapelle, 1993). It has been observed that the sequential dehalogenation of TCE results in the following degradation products: 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (CIS), trans-1,2-dichloroethene (TRANS), and vinyl chloride (Barrio-Lage et al., 1986). Twenty-six groundwater samples were collected in the area of concern using a Geoprobe system. Water quality analyses including seventeen analytes were then conducted in the field using gas chromatography. The samples were collected within one foot of the water table. Therefore, they only represent the upper flow zone of the unconfined surficial aquifer.

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### Preliminary investigation of relationship between geologic framework and the evolution of a barrier island coast in South Carolina

John W. Fields, Michael P. Katuna, and June E. Mirecki, Department of Geology

Over the past three years, and extensive drilling program along the central South Carolina coast has enabled us to investigate the regional subsurface stratigraphy and to expand our knowledge about the development of the modern coastline. Over fifty borings (approximately one hundred feet in depth) were taken along a seventy-five mile long stretch of coastline to determine the geological framework for the evolution of the Holocene barrier island system. The borings extend from Kiawah Island to Bull Island. Whenever possible, the borings penetrated the Quaternary-Tertiary boundary beneath each of the islands. Stratigraphic and biostratigraphic analysis of formational units coupled with seismic surveys and existing water well data have been used to develop a model for this region. Preliminary coast-parallel and coast-perpendicular stratigraphic cross-sections as well as structural contour and isopach maps of the subsurface were developed to show the relationship between modern barrier islands and antecedent topography. The amino acid racemization dating method was used to identify the Holocene-Pleistocene boundary, and to distinguish superposed lithologic units in the subsurface of the lower coastal plain of South Carolina. Fossil bivalve Mulinia samples were obtained from seven vibracores and seven auger borings on Folly Beach and Kiawah Islands. The samples were analyzed for Allo-isoleucine/Isoleucine (AILE/ILE) values. Holocene AILE/ILE values from Mulinia in near-surface deposits of coastal South Carolina typically are less than 0.1. Pleistocene AILE/ILE values increased down-core, although the values are sometimes discontinuous suggesting buried erosional surfaces preserved in these coastal lithologic sequences.

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### Preparation of 4-oxo-n-phenyl-4h-1-benzothiopyran-2-acetamides or 4-oxo-n-phenyl-4h-1-benzopyran-2-acetamides from Trilithiated Acetoacetonilides and Lithiated Methyl Thiosalicylate or Lithiated Methyl Salicylates

Kristen L. French, Mary E. Rampey, April J. Angel, Douglas R. Hurst, Angela R. Williams, Shannon L. Studer-Martinez, and Charles F. Beam
Department of Chemistry and Biochemistry

Trilithiated acetoacetonilides were prepared in excess lithium diisopropylamide, and these polyanion-type intermediates were regioselectively C-acylated with lithiated methyl thiosalicylate or lithiated methyl salicylates. This was followed by acid cyclization of intermediates (also poly lithiated) with aqueous hydrochloric acid to substituted 4-oxo-N-aryl-4H-1-benzothiopyran-2-acetamides (benzothiopyranone-acetamides) or 4-oxo-N-aryl-4H-1-benzopyran-2-acetamides (benzopyranone-acetamides). Since this is a regioselective condensation/cyclization process, only a single product results, which can be purified in multi-gram quantities by recrystallization from routine solvents. Also, every compound prepared in this
series is new, possibly due to the difficulty envisioned in their preparation by traditional multi-step syntheses.

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The Preparation of 5-Substituted, 1-Carbomethoxy-3-(2-Hydroxyphenyl)-1H-pyrazoles and Other 1H-pyrazoles from the Polyanion Type Intermediates of Carboalkoxyhydrazones and Phenylhydrazones

Douglas R. Hurst, Jennifer L. Roberts, Joy D. Avery, Kristen L. French, April J. Angel, Aseem Sood, Christopher D. Hornsby, Angela R. Williams, Mary E. Rampey, Shannon L. Studer-Martinez, and Charles F. Beam
Department of Chemistry and Biochemistry

C(a),N-Carboalkoxyhydrazones or the C(a),N-phenylhydrazone of 2-hydroxyacetophenone and related ortho-hydroxyphenyl ketones were trilithiated with excess lithium diisopropylamide, and the resulting trianion-type intermediates were condensed with a variety of aromatic esters followed by acid cyclization to the desired substituted, 1-carboalkoxy-3-(2-hydroxyphenyl)-1H- pyrazoles or 1-phenyl-3-(2-hydroxyphenyl)-1H-pyrazoles. Due to the close proximity of the hydrogen in the hydroxyl group to the nitrogen in the pyrazole ring, these products are potentially a new series of excited state proton transfer molecules. These molecules also have various electron donating/withdrawing substituents in a resonance position, which affords the opportunity to study the effects of substituents on charge transfer and in turn, proton transfer. Also, C(a),N-phenylhydrazones were dilithiated with excess lithium diisopropylamide and condensed/acid cyclized with either methyl 2-phenyl-4-quinolinecarboxylate, methyl (2-aminosulfonyl)-benzoate, or related esters to the substituted 1H-pyrazole products. Pyrazoles are well documented for their potential biological activity, especially in agriculture, and every compound targeted for preparation is new, possibly because of the difficulties envisioned using traditional preparative procedures.

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The Preparation of 5-Substituted, 3-(2-Hydroxyphenyl)-Isoxazoles, Other Isoxazoles and 4,5-Dihydroisoxazoles from the Dianion-type or Trianion-type Intermediates of Oximes and a Variety of Electrophilic Reagents

Angela R. Williams, Douglas R. Hurst, April J. Angel, Kristen L. French, Shannon L. Studer-Martinez, Christopher D. Hornsby, Jennifer L. Roberts, and Charles F. Beam
Department of Chemistry and Biochemistry

C(a),O-Oximes of 2-hydroxyacetophenone and related ortho-hydroxyphenyl ketones were trilithiated with excess lithium diisopropylamide followed by condensation with a variety of aromatic esters to intermediates (also polyliithiated) that were acid cyclized to 3-(2-hydroxy-phenyl)isoxazoles. Due to the location of the phenyl-hydroxy group in this series of isoxazoles, they have the potential to undergo excited state proton transfer. Also, C(a),O-oximes of ketones, such as substituted acetophenones, were dilithiated with excess lithium diisopropylamide and then condensed with lithiated hydroxybenzaldehydes, such as o-vanillin, or carboxylic acid anhydrides, such as succinic acid anhydride or ethyl cinnamate. Intermediates, such as b-hydroxyoximes, were not usually isolated, and condensation intermediates could be acid cyclized directly to give substituted isoxazolines or isoxazoles.

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The Condensation of Lithiated Phenylacetic Acids and Esters with Lithiated Salicylaldehydes for the Preparation of Coumarins and Related Materials

Anne E. Finefrock, April J. Angel, Kristen L. French, Angela R. Williams, Douglas R. Hurst, Christopher W. Alexander, and Charles F. Beam
Department of Chemistry and Biochemistry

During a preliminary study, several substituted phenylacetic acids or their methyl esters, dissolved in dry tetrahydrofuran, were monolithiated (esters) or dilithiated (carboxylic acids) with excess lithium diisopropylamide. The resulting anion-type intermediates were regioselectively condensed in an aldol-type process with lithiated salicylaldehydes, an anionic electrophilic reagent, to afford substituted propanoic acids or esters, propenoic acids, or coumarins. The successful reactions are examples of an anion undergoing a challenging condensation with another anion, where the electrophilic center of one of the reagents, the lithiated salicylaldehyde, is in a position for diminished activity, due to the location of the phenoxide anion (resonance position). Surprisingly, not all products were readily purified by crystallization and recrystallization from routine solvents, and flash chromatographic techniques had to also be used on occasion. The structure of the products were confirmed by absorption spectra, with additional support from combustion analyses.

The Preparation of 4,5-Dihydro-2h-benz[G]Indazoles, 4,5-Dihydro-2h-Benz[E]Indazoles and Related Materials from Dilithiated 1- Tetralone or 2-Tetralone Phenylhydrazones and Aromatic Esters

April J. Angel, Thuy-Ha V. Nguyen, Frederick J. Heldrich, and Charles F. Beam
Department of Chemistry and Biochemistry

Ibraheem T. Badejo, Bayer Corporation - Charleston

The phenylhydrazones of 1-tetralone and 2-tetralone were prepared and dilithiated with excess lithium diisopropylamide followed by condensation of the resulting polythiinated intermediates with a variety of aromatic esters. The resulting dilithiated C-acylated intermediates were treated with aqueous acid and heated under reflux, which resulted in acid cyclization to 4,5-dihydro-2H-benz[g]indazoles or 4,5-dihydro-2H-benz[e]indazoles. The condensation/cyclization process is regioselective, and only a single isomer results. Every product prepared in this series is new, and they were purified in multi-gram quantities by recrystallization from routine solvents. Related results will be presented along with the potential for oxidation of new dihydrobenzindazoles to substituted 2H-benz[g]indazoles or 2H-benz[e]indazoles.

Preliminary Exploration of the Methods of Nutrient Uptake of Dirofilaria immitis

A. Schmitt, Department of Biology

Dirofilaria immitis, the causative agent of dog heartworm disease, is a member of a group of nematode parasites, the filaria, that infect approximately one-hundred and twenty million people worldwide as well as many other mammalian hosts. It is unknown whether filarial worms intake nutrients through their intestines or transcutaneously. A functional intestine would indicate that filaria are able to digest serum. It would follow, that antibodies raised against filaria intestinal proteins could potentially kill these parasites. This preliminary study sought evidence that Dirofilaria immitis (D.I.) does have a functional intestine by
demonstrating the presence of carbohydrases, lipases, and proteinases. D.I. adult worms were dissected and their intestines homogenized. Protein contents of the homogenates were estimated by the Bicinchonnic Acid Assay (BCA); protein content of the gut was determined at 0.48 Âµg/Âµl. Leucine amino peptidase and lipase activity was determined using Sigma kits. Standard curves for LAP and lipase were prepared and compared with the results of the assays on the homogenates. When compared to the (LAP) standard curve, the leucine amino peptidase activity showed an average 0.98 units per Âµg of intestinal protein. The lipase assay demonstrated 0.72 units lipase per Âµg of intestinal protein. Arne Dahlqvist's Method for Assay of Intestinal Disaccharidases was used to test for carbohydrase activity; however, absorbance remained constant with increasing maltase levels; therefore, no standard curve could be created. The absorbance also remained constant for the D.I. homogenate. For the enzymes in the worm homogenate tested so far, trace amounts were demonstrated for leucine amino peptidase and lipases. The maltase assay was completely inconclusive and a new method will be employed in the future as a standard curve could not be created from this assay. These assays, however, represent only a few of the possible enzymes which may be utilized by D.I. for its digestion. Further tests are planned to assay for several other enzymes. Therefore, at this stage, the intestine functionality of Dirofilaria immitis cannot be confirmed. This project is ongoing and other methods will be explored and incorporated.

30

Land-Use Study of Charleston County Using Thermal Data From the MODIS Airborne Simulator

Deanne Rogers and Steven V. Stearns, Department of Geology

MODIS Airborne Simulator (MAS), flown on a high-altitude NASA ER-2 aircraft, has 50 non-continuous bands ranging from 0.5 to 14.5 microns. MAS is a unique instrument in that it is equipped with nine thermal bands, ranging from 8.3 to 14.5 microns. Thermal remote sensing is excellent for the detection of commercial, industrial, and residential urban development; however, in the past, MAS has primarily been used for atmospheric, wildfire, and ice studies. Because of its multi-band thermal sensors and 50m pixel resolution, MAS is a useful instrument for the monitoring of urbanization. A comparison of MAS and LANDSAT-5 images shows that MAS is the best remote sensing instrument for this purpose. An example of this comparison has been used with MAS overflight data of the Charleston area, from August of 1997. By overlaying digital landuse classifications provided by the South Carolina Department of Natural Resources on high-resolution SPOT data, features in the MAS and LANDSAT-5 images could be identified by visual comparison. Once the features that could be classified as urban were determined, the reflectance of MAS thermal bands and LANDSAT-5 band 7 (2.1-2.3 microns) were compared. When using MAS thermal bands, the urban features were consistently brighter than surrounding untouched vegetated areas. When using LANDSAT-5 band 7, the brightest features were mostly urban; however, some did not fall into the urban classification scheme. LANDSAT-5's only thermal band, band 6, could not be used because of its poor resolution. In conclusion, LANDSAT-5 has better spatial resolution; however, it does not always distinguish urban versus non-urban features. Therefore, in late 1998, satellite MODIS data should prove better than LANDSAT-5 for the monitoring of regional urbanization.

31

The Use of drugs and alcohol among students at the College of Charleston

Leilani Jay, Jennifer Schaller, and Katy Donahue
Department of Mathematics

Our information was taken from a convienent sample of statistic students at the College of Charleston. We compared this information with the information we received from the Core Drug and Alcohol Survey-form
191. Using graphs, histograms, pie charts, and various line graphs we will show the uses and abuses of drugs and alcohol among college students. Our research also will include ways in which the College can help to curb the problem.

32

Preliminary Results of a GIS Development: Allan Hills Meteorites, Antarctica

Kurt McCoy, Thomas Covington, Kristi Coker, and Tara Cutter
Department of Geology

Meteorites are found all over the world, but are mostly abundantly preserved in the polar ice caps. Due to the vast sheets of ice and the contrasting color of the meteorites where exposed, they are readily distinguished and collected, for study. Several groups of planetary scientists have compiled data form the analysis of these meteorites found in the Allan Hills region of Antarctica, but have failed to construct a workable database. Using data collected by NASA and employing GIS (Geographic Information Systems) software, we constructed a database which can be used to identify sample locations within a map, query the information obtained for these samples and perform statistical analysis based on specified parameters. Grouping the samples by classification type creates the primary division of the samples being researched. Further subgroupings based on petrologic and geochemical data will ultimately be developed to improve the GIS. This will facilitate chemistry of samples and greatly expand scientific query opportunities. For example, we could examine geochemical clusters to determine if they were part of a larger single meteorite which fragmented in the atmosphere.

33

Shoreline sediments and Vibrio spp.; can some animals amplify the risks?

Laura Flinn, Department of Biology

Bacteria in coastal waters, shellfish intended for human consumption, and drinking water supplies present a serious threat to human health. In many parts of the world these bacteria cause food poisoning outbreaks, cholera epidemics, and dysenteric diseases. Pathogens often include members of the genus Vibrio. It has been suggested that the digestive tracts of deposit feeders in shoreline sediments may serve as reservoirs for bacteria, and that this effect may be specific to a particular group (e.g. Vibrio spp.). To test this hypothesis, a site was chosen in the Charleston, SC area and surveyed in early 1998. Deposit feeders were dissected on-site using aseptic technique and the contents of the hindgut collected. Sediment samples were taken concurrently at one meter from each animal. All samples were spread on general and Vibrio-selective media plates at varying concentrations and colony-forming units were enumerated at 24 and 96 hours. Numbers were compared across site of collection (hindgut vs. sediment) and type of colonies (heterotrophic vs. Vibrio). One species of deposit feeder was found to have significantly higher Vibrio concentrations in hindgut vs. corresponding sediment, indicating that it may serve as a reservoir.

34

A Search for Light Variations in the Lambda Bootis Star HD111604

Jennifer L. Jordan and Robert J. Dukes
Department of Physics & Astronomy
Bohlendher, et al. (Astron. Astrophys. 307, 19-112, 1996) have found evidence of non-radial pulsation in the line profile variations of the Lambda Bootis star HD111604. At their request we put this on the observing program of the Four College Consortium Automatic Photometric Telescope. In this paper we report on an analysis of approximately 145 Stromgren uvby observations obtained during the 1997-98 observing season. The analysis of the APT data indicates that the program star is variable and probably has multiple modes excited. Thus far two frequencies have been found: a 5.3 c/d and an 11.6 c/d. This work has been supported in part by NSF Grant 95-28906 to the College of Charleston and in part by a grant from the South Carolina Space Grant Consortium to the first author.

35

The Role of Calpain-Calpastatin in Spinal Cord Injury

Carmeka Stevenson

It has been determined that the expression of the family of calcium activated neutral proteases (calpains) may be involved in many neural functions. Calpains are calcium-dependent cysteine proteases containing a 78-80 kDa catalytic subunit and a smaller 25-30 kDa subunit. Its endogenous inhibitor, calpastatin, regulates calpain proteolytic activity and cell membrane binding. Previous work provides evidence that calpastatin inhibits the binding of calpain to cell membranes through a regulatory inhibition site other than the inhibitory sequences. It is also suggested that high concentrations of calpastatin are found in the cellular membranes while lesser concentrations are found in the cytosol. Because calpain has been implicated in cellular damage that occurs due to ischemia and degenerative diseases, we hope to determine the status of calpastatin in calpain regulation by immunocytochemical expression in spinal cord injury. Therefore, the purpose of this experiment is to determine if there is any change in calpastatin expression due to the increase in calpain in spinal cord injury. We found no significant increase in calpastatin translation expression in spinal cord injury rats compared to sham controls.

36

Osteological Preparation of Gavia Stellata

Christopher Clay Jenness, Dept. of Biology

The presentation will show the skeletal anatomy of Gavia Stellata (Red Throated Loon), and explain the processes taken in order to model the skeletal features of the skeletal mount, along with a minute amount of information on the biology of Gavia Stellata. The project was taken on by the student for aesthetic reasons, and logistical challenges.

37

Morphological Divergence in a New Species of Deep-Sea Hydrothermal Vent Amphipod

Steven N. Reuland, Department of Biology

Amphipods in the genus Schisturella are common in the deep-sea, with species being found in all oceans. A closely related genus/species named Ventiella sulfuris is endemic to the deep-sea hydrothermal vents of the eastern Pacific and has a geographic range spanning two ridge systems. This species is thought to be derived from a species of Schisturella. A genetically divergent amphipod population has recently been discovered.
at a single vent location within the range of *V. sulfuris*. This project examined the morphology of these amphipods to determine if they are a species distinct from *V. sulfuris*. Morphological analysis using dissecting microscopy has uncovered several taxonomically important character differences. Among the most important are the notched inner ramus of the second uropod and the serrated posterior margins on the second segments of pereopods 5-7, both of which are features of the new amphipod but not of *V. sulfuris*. These character differences, in addition to several others, have led to the conclusion that these amphipods are a new species, distinct from *V. sulfuris*, probably belonging to the genus *Schisturella*. The next step in this study will be to sequence a portion of the mitochondrial 16S ribosomal RNA genes of these new amphipods as well as a *Schisturella* outgroup. When compared to preexisting sequences from *V. sulfuris*, this new data will allow us to determine if V. sulfuris is derived from this new species or from another member of *Schisturella*.

38

**The Effects of Metformin on Cell Membrane Fluidity and Glucose Transport**

Heather Ferris, Department of Biology

Sixteen million Americans have diabetes mellitus. 90-95% of these cases are non-insulin dependent diabetes mellitus (NIDDM). Serious complications may develop from uncontrolled NIDDM. For people who are unable to control their diabetes with diet and exercise alone drug therapy is often instituted. One such drug used is metformin. Only recently approved by the FDA, metformin has been in use in Europe and Canada for nearly 25 years. Despite its long history as a diabetes drug, the modes of action are still poorly understood. Proposed mechanisms for metformin action include increased glycogenesis, peripheral tissue glucose absorption, incorporation of glucose into triglycerides, and decreased gluconeogenesis. Here I will focus on the effects of metformin on peripheral tissue glucose absorption. Recent studies indicate that metformin increases the membrane fluidity of erythrocytes. This poses several interesting questions for further research concerning metformin. Does metformin effect other cell membranes in the same manner? What is the function of this increased fluidity? The GLUT4 glucose transporter is known to be sequestered in vesicles in the cell cytosol. It is not until insulin stimulation that GLUT4 is translocated to the cell membrane. Does increased membrane fluidity cause GLUT4 to be more quickly translocated and then recycled back into the cell? Below is a proposal on how to further elucidate some of these questions. First, the effects of metformin on membrane fluidity in adipose and skeletal muscle tissues must be assessed. These are the main tissues containing GLUT4 transporters. Assuming that the cell membranes react similarly to erythrocytes when treated with metformin the next step is to look at the behavior of the GLUT4 transporter in treated and untreated cells. By answering these questions we will gain a better understanding of both the mechanisms of metformin and the functioning of the GLUT4 transporter.

39

**Proofs Without Words on the World Wide Web**

Aaron Whitney and Anthony Leclerc
Computer Science Department

"Proofs without words" (PWWs) are features regularly published by the Mathematical Association of America—notably "Mathematics Magazine" and "The College Mathematics Journal." The original motivation behind PWWs was to supplement an otherwise "dull proof" with a "geometric analogue so simple and beautiful that the truth of a theorem is almost seen at a glance."

The research presented here introduces new design concepts and implementation techniques for augmenting PWWs within the dynamic realm of the World Wide Web (WWW). The WWW is a medium which
permeates virtually every institution, organization, and household. The WWW is also a more robust medium than the printed journal in that it allows for interaction as well as sound, color, and animation (i.e. Multimedia).

This research project focuses on the design and implementation of one particular PWW example: An interactive version of Cavalieri's Principle for determining the volume of a Hemisphere. Tzu Geng, son of the most celebrated mathematician Tzu Chung Chih in ancient China, was believed to be the first to develop the principle in the fifth century A.D. (a long time before Leibniz, Newton and Calculus)! Highlights of Java, the platform independent programming language used to implement the given example (and currently THE language for WWW development), are given throughout the presentation.

40

Mount Pinatubo Mudflow Analysis Using Remote Sensing: Preliminary Investigations

Jeffrey Nettles and Cassandra Coombs, Department of Geology

The 1991 eruption of Mount Pinatubo emplaced about 5 to 7 km³ of pyroclastic ash. Lahars (volcanic debris flows) flush much of this unconsolidated debris from Pinatubo's upper slopes with each heavy rain. Whole villages have been washed away or buried by the continued occurrences of these lahars. Attempts have been made to control the lahar flows through the construction of levees; however, the levees have already begun to fail. An extensive database of Space Shuttle imagery exists that can be used to determine the changes in lahar occurrence over time. Work to date on this project has largely centered around determining the methodology to be used in completing this time-series analysis. Shuttle images were downloaded, warped, and cropped to contain the same spatial coverage. Contrast stretches were applied to enhance variations in the images. Several methods of determining the spatial change over time of the lahar deposits were explored, including simple methods such as image subtraction, and more complex methods such as principle components analyses. Results of each method are presented and discussed. This study is being performed with the intent of identifying the areas surrounding Pinatubo that are most susceptible to future lahar flows.

41

Early Eocene Perissodactyla from the Great Divide Basin, Wyoming: Implications for Biostratigraphy

Allison Cleveland, and Dana A. Cope
Dept. of Sociology/Anthropology

For the last five years, a joint team from SUNY-Geneseo and the College of Charleston has been collecting mammalian fossils from the Fort Union (Late Paleocene) and Wasatch (Early Eocene) formations in the Great Divide Basin, Wyoming. Fossils were last collected there at a small number of localities by Gazin and personnel from Smithsonian Museum of Natural History in the late 1950s and early 1960s. Since the origination of the Great Divide Basin Project five years ago, dozens of fossil mammal localities have been identified in addition to those found by Gazin, and over 2,000 mammal specimens have been catalogued. The localities span a wide geographic range with exposures of limited stratigraphic range. The purpose of this study is to identify biostratigraphically significant perissodactyl species from the Wasatch formation, including the early horse Hyracotherium. Thus we can correlate the dates of our localities with previously well documented stratigraphic sequences in the Clark's Fork, Bighorn and Wind River Basins to the North. An independent analysis of perissodactyl species in our basin can then be compared to specimens of other taxa as a cross check on conclusions regarding the biostratigraphy of these localities.

Lower molars were primarily used in species identification, since these figure most prominently in literature
descriptions. Since much of our sample consists of isolated teeth, it was first necessary to develop a reliable system of correctly identifying these by position in the tooth row. Then, species identification could generally be made on the basis of two major criteria: 1) Development of the protoloph and metaloph, which has been widely been employed in species diagnosis of Hyracotherium and other perissodactyls since the 19th century up to the present. 2) Statistical analyses of size and variation previously applied by Gingerich (1991). Based on these qualitative and quantitative data, we feel confident in diagnoses of these fossil species. This will be an important contribution to the interpretation of the paleontology of the basin, since subsequent analyses of environmental and evolutionary changes in the basin and comparisons to other areas are dependent on reliable dating.

The results confirm that specimens analyzed for this project date to the Wasatchian North American Land Mammal Age (Early Eocene), which has traditionally been divided into four subages. The earliest of these is the Sandcoulian, followed by the Graybullian, Lysitean and Lostcabinian, respectively. The presence and distribution of equid species, such as H. pernix and H. aemulor, the tapiroid Homogalax and the complete absence of the Lysitean tapiroid Heptodon and the Lostcabinian taniotothere Lambdatherium, suggest that localities in the eastern portion of The Basin (e.g., The Tipton Buttes/ Virgin Hills area) represent a relatively late time period within the Graybullian Subage, while the more westerly localities (e.g. Gazin's Red Desert Locality) represent a middle Graybullian stage. It is also possible to correlate our localities with some accuracy to more precise stages of the Graybullian as proposed by Gingerich and others for the Clark's Fork Basin. Specimens collected last year and not yet catalogued from localities in the Salt Sage Draw and Freighter Gap areas will probably broaden the time range represented in the Great Divide fauna.

42

Preparation of the skeleton of Python molurus

Katherina E. Diemer and Wendi O'Connor, Department of Biology

In spring of 1997, the remains of a 16 foot Burmese python, Python molurus, were donated to the Department of Biology, at the College of Charleston, Charleston, South Carolina. The skeleton of this specimen was prepared for mounting as a teaching and display resource. After removing most of the muscle mass, the specimen was disarticulated in approximately 12 inch sections. The sections were processed by bacterial maceration, in separate containers, over several months. When maceration was complete, each bone sequence was cleaned with a degreasing agent, bleached with dilute hydrogen peroxide, and dried. For the display mount, a template for the final pose of the snake was drawn onto a wooden workboard. The vertebral column was reinforced with brass wire and attached to the base on plexiglass posts, spaced at 12 inch intervals. Ribs were subsequently glued to the vertebral column.

43

Geochemical Modeling of Groundwater through Ca(OH)2-rich Sediments at the Charleston Naval Base, Charleston, South Carolina

Robin Humphreys and June Mirecki
Masters of Environmental Science Program

A caustic, Ca(OH)2-rich pond at Solid Waste Management Unit 11(SWMU 11) at the former Charleston Naval Base was covered with topsoil as part of a remediation process. Previous analyses show localized regions of pH levels as high as 12.7 in the soils and surface waters on the site. The purpose of this study is to model the geochemical changes of groundwater as it travels downgradient through the Ca(OH)2 aquifer material. Water quality analyses were conducted on samples from three wells screened in the unconfined aquifer, as well as from the surface water in the ditch next to the downgradient well. Transition metal and
major element concentrations were measured by ICP-AES following EPA procedures. The USGS NETPATH modeling code was employed to model the geochemical evolution of the groundwater along the flowpath between upgradient and downgradient wells and surface water. Analyses of the upgradient and downgradient water samples show increasing concentrations of calcium, chloride, hydrogen sulfide, alkalinity, and pH levels with decreasing concentrations of dissolved oxygen and sulfate. The saturation indexes for the upgradient and downgradient samples indicate that the groundwater is becoming more saturated with respect to calcium as it flows through the aquifer. The increase in calcium saturation suggests that the Ca(OH)$_2$-rich sediments are dissolving along the flowpath, and thus are contributing to the increased alkalinity and pH levels found downgradient. Further analysis of the sediments in the surface water ditch will reveal the exact mineralogy (i.e. calcite or portlandite) of the compounds that are precipitating.

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Using Remote Sensing to Locate Potential Hominid Fossil Sites

Jack Stalnaker

A Landsat TM image of the Hadar region of Africa was analyzed to produce a map of potential hominid fossil sites. Clay minerals indicative of the Plio-Pleistocene beds that contain fossil hominid material were mapped using Landsat TM band ratios. Because the outcrops of the Plio-Pleistocene beds are fault-controlled, only the clay minerals occurring along rift grabens were retained, yielding a more accurate map of the Plio-Pleistocene beds.

The use of satellite imagery may aid the search for hominid fossil remains. Large scale perspectives in combination with the ability to discriminate surface material can significantly limit the search for such materials. As remote sensing technology changes, and ground data are made available, the map can become more complete.

45

Examining the World of Microfossils

Students of GEOL 107 (Introduction to Coastal and Marine Geology)

Students in the Introduction to Coastal and Marine Geology course participated in short research projects to study a variety of microfossil groups. The purpose of the project was twofold: (1) to engage students in several stages of a research project, from sample preparation and analysis to presentation of results; and (2) to demonstrate to students potentially strong linkages between biology and geology. Teams of three to four students each examined sediment core samples from tropical waters and extracted specimens of a particular microfossil. Students then used the Scanning Electron Microscope to explore specimens in detail and take photographs. Examples of the microfossil groups presented are planktonic and benthic foraminifera, pteropods, radiolaria, and ostracodes. Each team will present their work, including the morphology, ecology and paleoceanographic use of these organisms.

46

Ichthyological Results of the Netherlands Indian Ocean Program 1990-1995: 3. Distinctions and Depauperacy of the Red Sea Mesopelagic Fish Fauna
Only eight mesopelagic fish species are known from the Red Sea: *Astronesthes martensi* (Stomiidae), *Benthosema pterotum* (Myctophidae), *Bregmaceros arabicus* (Bregmacerotidae), *Diaphus coeruleus* (Myctophidae), *Lestidiops luetkeni* (Paralepididae), *Maurolicus muelleri* (Sternoptychidae), *Stomias affinis* (Stomiidae), and *Vinciguerria mabahiss* (Photichthyidae). A ninth species, probably pseudo-oceanic, is *Harpadon erythraeus* (Synodontidae). Three of these, *A. martensi*, *H. erythraeus*, and *V. mabahiss* are known Red Sea endemics. Very preliminary indications suggest that the Red Sea population of *B. pterotum* may also be distinct from the northern Indian Ocean form. The depauperacy of the Red Sea mesopelagic fauna is in marked contrast with the considerably richer faunas of the closely-adjacent Gulf of Aden and northwestern Indian Ocean. The line of separation is between Bab-el-Mandeb, where the main channel is 20 km broad and 300 m deep, and the point where the sill is near the Great Hannish Island, the channel is only 100 m deep. Oceanic depths (in excess of 2,500 m) occur in both the Red Sea and Gulf of Aden. Despite near continuous surface inflow from the Gulf of Aden, which should allow substantial recruitment of pelagic organisms and/or those with planktonic larvae, for virtually all taxa a large proportion of species widespread in the Indian Ocean are missing as residents in the Red Sea. No doubt contributing to this distinctness are such unique hydrographic features of the Red Sea as near isothermality at about 22 degrees Celsius and near isohalinity at 40.5 ppt of waters deeper than 200 m. Physical exclusion by extreme deepwater conditions of temperatures and salinity seems a likely explanation for impoverishment, as indexed the striking differences between 200 and 400 m on either side of the sill with up to a 10 degree C difference in temperature and a 4 ppt difference in salinity. This has marked effects on the day/night temperatures experienced by vertically migrating organisms on either side of the sill, clearly shown by our data on mesopelagic fishes from both areas. Our preliminary data show the distinctness of the two faunas, corroborate the species-level distinctness of the Red Sea endemic *Vinciguerria mabahiss*, suggest that a more detailed examination of Red Sea material may establish distinctiveness in the case of *Benthosema pterotum* and perhaps other Red Sea species, and relate this distinction to the unique physical environment of the Red Sea mesopelagial.

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**Morphological Variances of Planktonic Foraminifera in an Equatorial Region**

Kimberly Owens and Leslie Sautter, Department of Geology

The purpose of this project is to determine the possible cause for seasonal morphological variance in the planktonic foraminifera *Globorotalia menardii*. *Globorotalia menardii* is a non-spinose species found at the study Site HSS (Hight Surface Seasonality) in the eastern equatorial Atlantic off the northwest coast of Africa, near a major area of coastal upwelling. Site HSS is located at 14°18'N and 18°48'W where surface water temperatures vary from 20 to 28°C over a one year period. The thermocline depth here changes seasonally from 30 to 50 meters. A PARAFLUX Mark VII sediment trap was used to collect 21 continuous time-series samples at site HSS for a one year period. The trap was moored at a depth of 3,317 meters from June 24, 1993 to June 16, 1994. The procedure of study includes measurement of morphological features of *G. menardii* such as length and width of shell, and keel width. The cups analyzed include alternate samples of only 10 of the total 21 samples. The peak shell flux for *G. menardii* is approximately 145 shells/m²/day and occurs during the fall season. The morphologic data will be statistically analyzed and compared with variables such as flux, sea surface temperature and thermocline depth to determine potential relationships.

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**Morphological Variances of Planktonic Foraminifera in an Equatorial Region**
Chad George and Leslie Sautter

The purpose of this project is to establish an explanation for seasonal morphological variation of the planktonic foraminiferal species *Neogloboquadrina dutertrei* at the HSS a tropical Atlantic site. The species *N. dutertrei* is non-spinose and typically resides in the thermocline between 50-100 meters water depth. *N. dutertrei* is common in upwelling environments and prefers thermally stable or stratified environments in tropical and sub-tropical regions. The HSS site is located off the northwest coast of the African continent at $14^\circ 18'N$ and $18^\circ 48'W$. Site HSS has a thermocline that ranges from 30 to 50 meters seasonally and surface water temperature that varies from 20 to 28$^\circ$C over an annual period. Twenty-one continuous time series samples were collected with a PARAFLUX Mark VII sediment trap. The trap was moored at a depth of 3317 meters from June 24, 1993 to June 16, 1994.

Morphologic variables of *N.dutertrei* measured included length, width, size of last chamber and 2nd to last chamber. Another morphological variance observed and recorded was the number of chambers in the final whorl and if the species had an umbilical tooth. Morphologic data were compared to sea surface temperature, total flux and depth of thermocline over a seasonal period. By making these comparisons we hope to find a correlation between the morphologic and hydrographic environment.

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**49**

**Fundamental Parameters of Spectroscopic Binary System HD135240**

Debra Seyle, Department of Physics & Astronomy

Fundamental parameters of eclipsing spectroscopic binary star system HD135240 include radial velocities and projected rotational velocities by cross-correlation. Interactive Data Language (IDL) existing program routines were used to extract the parameters. Other parameters determined include tomographic separation and spectral types.

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**50**

**Meteor Imaging Through CCD's**

Shawn Danko and T.R. Richardson, Department of Physics and Astronomy

In this part of the project I looked at the Mckinley formula for efficiency of photographic methods of meteor detection. This formula takes into account several different factors such as sky area covered, focal length, film format and others. His results were given in numbers of meteors detected per 100 hours of observing. From here the purpose of this project was to manipulate his formula to take into account the CCD unit that the College of Charleston has, along with the 8.5mm cinematography lens we used. Not only did we use his formula to calculate the efficiency for the CCD unit to compare it to other photographic methods but we have also looked into other factors that impact the efficiency of a camera or CCD. For example the quantum efficiency of a detector whether it is a CCD pixel or a silver grain on a photographic plate.

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**51**

**An evaluation of the JUGS Radar Gun**

R. Godsen & B. Barfield, Physical Education and Health
Sports radar guns have been used for years to provide quick and supposedly accurate speed information in a variety of sport settings. The problem is that these speed estimations may be apocryphal. We had shown previously than one such device, the Sports Radar 3200, did not meet the accuracy claims of its manufacturer. This study was conducted to evaluate the JUGS radar gun. The manufacturer, JUGS, Inc., claims an accuracy (validity) of Â±1 MPH. We decided to evaluate this claim indirectly since our motion analysis data of the JUGS gun were inconsistent. We collected simultaneous projectile data using two JUGS guns placed side-by-side. Since validity cannot exceed reliability, we could refute the manufacturer's claim if the two JUGS units did not yield speed values which were consistently within Â±1 MPH. We decided that if 95% of the throws were within Â±1 MPH, then we would have to proceed with more detailed motion analysis; otherwise, we could refute the manufacturer's claims on the basis of inadequate reliability. In all, one-hundred-seventy duplicate estimations (all baseballs) were made during six separate data-collection occasions. Overall, there was concordance (values within Â±1 MPH) between the two units in only 40% of the trials, and the average absolute difference was 3.6 MPH. Although there were two "runs" of ten consecutive throws with 90% concordance, the 95% criterion was never challenged. We conclude that the JUGS gun does not meet the manufacturer's Â±1 MPH accuracy claim.

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Directed Forgetting of Faces

Jenn Daniels, Julia Jennings, Jenny Love, Joseph Lumpkin, Colleen Oakley, and Laurel Rosenberg - The Honors Program

David Gentry and Susan Simonian - Psychology Department

"Directed forgetting" refers to the decreased memory for words that subjects are instructed to forget. Cognitive and physiological processes for facial memory are potentially different from those for words (e.g., prosopagnosia is a specific deficit in facial recognition). Thus, we wanted to determine if directed forgetting would occur for faces as well as words. The subjects were shown a mixed list of 20 faces and 20 words, half of the words and faces were followed by instructions to REMEMBER and half to FORGET the preceding item. Then a list of 20 OLD faces and 20 OLD words was presented with 20 NEW faces and 20 NEW words interspersed. Nineteen subjects were asked to indicate if the face or word was OLD or NEW, and to rate their confidence in their response on a 5-point Likert scale. The results showed that the directed-forgetting effect did occur with words, but there was no significant finding of directed forgetting of faces. The confidence ratings showed that subjects were significantly more confident when they identified correctly an OLD item compared to when they failed to identify an OLD item. The subjects were also significantly more confident in their decisions for words than for faces. This preliminary study produced many unanswered questions that will lead to further research.

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How resistant are floppy diskettes to corruption?

L. Christovich, A. Baker, B. Bosold, K. Graham, A. Manning, and R. Godsen, Physical Education and Health

The purpose of this study was to determine how resistant floppy diskettes are to file corruption. Five diskettes (three Verbatim, two BASF) were put through a series of typical "accidents" to determine their resistance to external corruption. In sequence, they were taken through the library security scanner and the airport's security scanner, then through magnetic scanners at either Revco, Eckerd, or Home Depot. Following this, they were placed on top of a microwave oven while it was "cooking." The next test was to
place them on top of a magnetic business card. Each diskette passed this series of "accidents" successfully with no file corruption (Macintosh). The final test was a water bath, in which each diskette was "bathed." After opening the diskette and drying the "cookie," an evaluation was made of the state of the diskette's buffer cloth. If it was intact, then the diskette was taped back together and inserted into the computer. If the buffer cloth was wrinkled, the "cookie" was transplanted into a verbatim "surrogate" shell and tested. The three Verbatim diskettes passed, one without assistance; the other two diskettes required Norton Utilities intervention with one file being lost. Three additional diskettes were tested using hot coffee, coke, or coke and sand ("beach" accidents). Each diskette so tested was rendered useless. Our pilot study suggests that all may not be lost if you accidentally expose your diskette to a hazardous situation. Consider this caveat, however. If your diskette is exposed to coffee or coke, you may transfer the contaminant from the "cookie" to your diskette drive reading head. To circumvent this potential problem, we suggest that you use your neighbor's computer for diskette repair.

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Foraminiferal and Nannoplankton Biostratigraphic Interpretation of Subsurface Stratigraphic Units, Kiawah Island, South Carolina

Gwendolyn Burns, A. Kem Fronabarger, and Michael P. Katuna Department of Geology

Foraminiferal assemblages were analyzed from sediment samples obtained from deep borings made on Kiawah Island, South Carolina during the summer of 1997. Four auger holes (KID 2, 4, 7, and 10) drilled on the island were sampled at five foot intervals and depths ranging from twenty-five to one hundred feet below the surface. Two hundred specimens of foraminifera were separated from each of the samples to determine the age of the strata. Many species of foraminifera were identified, but only those with limited life spans are useful for biostratigraphic interpretation, these include: Globigerina praebulloides leroyi, G. opima-nana, G. praebulloides praebulloides, G. ouachitaensis ouachitaensis, G. ciperoensis angulisuturalis, G. ouachitaensis gnaucki, G. ciperoensis ciperoensis, G. medizzai, G. eocaena, Catapsydrax dissimilis, Pseudohastigerina micra, Hastigerina cf. bolivariana, Globorotalia mayeri, G. opima-opima, Chiluoguembelina cubensis. Newly established P zones were compared with NP zones previously reported from this area. The subsurface stratigraphic units are believed to range from middle Oligocene to middle Eocene in age. Oligocene age sediments were observed in each of the four holes at depths ranging from twenty-five to ninety feet. Middle Eocene age strata were identified from two sites KID-7 (100 feet) and KID-10 (80 feet). The biostratigraphic data closely agrees with the previous lithostratigraphic interpretation of foraminal units. A conflict in P and NP zones accounts for the data in which there is no fit.

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Recognition of Facial Affect in Social Phobic Children

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The inability to accurately judge facial affect has adverse effects on the quality of interpersonal relations (Knapp & Hall, 1992). Research on facial affect recognition suggests that social withdrawal may be one factor responsible for limited ability to recognize facial emotion. Although social skills deficits are common in both adults and children with social phobia (Turner & Beidel, 1992; Beidel et al., 1998), the ability to judge facial affect has not been studied. The present investigation examined the ability to judge facial affect in a group of children meeting DSM-IV criteria for social phobia and a matched group of normal controls.
Fifteen social phobic children ages 9-15 years and 15 control children ages 9-15 years participated in the study. Thirty-six slides from the Pictures of Facial Affect (Ekman & Friesen, 1976) were presented to each participant. Children were asked to identify one of six emotions (e.g., happy, sad) depicted by the model in each slide. In addition, participants were asked to rate their pre- and post-task anxiety on a 5-point pictorial Likert scale. Results indicated that social phobic children made significantly more errors in recognition of facial affect than did control children. There were no significant differences in total errors based on gender, and no significant differences between groups on self-reported anxiety ratings either at pre- or post-test. A MANOVA examining group differences in the number of errors based on type of facial affect was significant. Univariate analysis indicated significant differences between social phobic and controls for slides depicting happy and surprised faces and faces evidencing disgust. Multiple regression analysis indicated that group membership, age, race, grade, and self-reported pre- and post-task anxiety accounted for 63 percent of the total variance in facial affect recognition scores. Findings were discussed in terms of social perception training as a necessary component of social skills treatment programs for children with social phobia.

Automated Absentee Notification System

Kathy Brueser, Elainna Gaskins, Tori Smith, and Mary Anna Mullinax
Department of Computer Science

With over 12,000 students at the College of Charleston there are more than 100 absences reported weekly to the Office of Undergraduate Studies. Unfortunately this office only has three people to process these requests. Therefore, a networked, campus software system was developed to further automate the current system in order to handle more efficiently the growing number of absence requests received and to more quickly inform professors of an absence. The hardware consisted of personal computers (PCs) and a VAX machine located at the College of Charleston. The PC software retrieved information from the user about the absence and saved this information in a file for each student. The PC software also retrieved statistical information which was added to a running tally of statistical information on the office's network drive. This software then sent the files containing information on student's absences through ftp to the VAX. The software on the VAX merged this information, along with the information it extracted from the Student Information System, into an e-mail template on the VAX. These e-mail memos were then distributed to the professors via e-mail. Benefits of the system include the reduction of time spent processing each student absence, the delivery of the notification memo to the professors in a timely manner, and the elimination of unnecessary user effort.

Creek Bank Erosion of the Tidal Salt Marshes of Murrells Inlet and North Inlet, South Carolina

Jaime R. Chose and Cassandra Coombs
Masters of Environmental Studies Program
This study attempts to determine what factor or combination of factors, both natural and anthropogenic, most influence erosion of salt marsh tidal creek banks. Parameters affecting creek bank erosion will be identified along with determining how many acres of wetlands have been lost due to creek bank erosion. The potential factors influencing erosion of the creek banks in salt marshes include: boat induced waves, erosion control devices, docks/marinas, plant density and species composition, burrowing fauna, oyster beds, tides and currents, wind and waves, storm events, bank slope, channel dimensions, soil type, and stratigraphy. Aerial photography and other remotely sensed images will be used to determine historical changes in creek banks locations. The final product will the development of a Geographic Information System that will identify areas where erosion has occurred in the past and areas currently undergoing erosion, along with identifying areas that may have potential for severe erosion. The information derived from this study will be used to compare a highly urbanized estuary, Murrells Inlet, to a pristine estuary, North Inlet, to determine whether urbanization influences erosion of the tidal creek banks.

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Psychosocial Issues of Cystic Fibrosis

Heather Greer and Robert T. Dillon, Jr., Department of Biology
Deborah Anderson, Clinical Services
MUSC and Department of Biology, College of Charleston

Recent medical advances in Cystic Fibrosis (CF), the most common fatal genetic disease in the US, have increased the mean age of survival to 31 years. As these children grow into adulthood they face unique psychosocial issues, such as the transition from pediatric to adult care. In this study I interviewed 13 patients at the Adult CF clinic at MUSC about their experiences moving to pediatric care and their social networks. I hypothesized that those with greater support networks would have lower levels of depression and anxiety, and have greater ease discussing CF with others. Analysis of variance did not uncover a significant relationship between support network (as measured by the number of friends reported) and scores on either the Beck Depression Scale or the Spielberger State and Trait Anxiety Scales. Nor did median tests uncover relationships apparent between support network and three categorical variables measuring communication skills, such as the number of people who have been informed. This study will be expanded to include larger samples sizes and refined indices of social network and psychological interaction.

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Exogenous Retinoic Acid During Gastrulation Induces Cartilaginous Defects and Multiple Fins in Fundulus heteroclitus

Mark Vandersea and Denice Smith
Grice Marine Biological Laboratory and Department of Biology

Robert McCarthy and Paul Fleming
Department of Cell Biology and Anatomy, MUSC

Retinoic acid (RA) plays a critical role as a signaling molecule in normal axial patterning of vertebrares. To understand the effects of RA signaling in F. heteroclitus, we exposed embryos to a range of RA concentrations for two hours during gastrulation. Embryos exposed to RA (5 x 10^{-7} - 10^{-4} M) develop dose dependent defects. Analysis of cartilage development demonstrates distinct patterns of deletions in the neurocranium and pharyngeal skeleton in response to increasing concentrations of RA. Our results suggest that dorsal and ventral cartilage elements of the pharyngeal arches are differentially sensitive to early
exposure to RA and may originate from different populations of neural crest cells along the embryonic axis. The non-contiguous pattern of deletions of ventral elements indicates a more complex regulation or axial organization than has been previously recognized.

RA exposure of zebrafish and F. heteroclitus embryos during gastrulation results in homeotic duplications of the pectoral fins in up to 94% of fish. We have observed three to four pairs of fins in an individual fish. Although some duplications are partial, many represent complete axial duplications of the pectoral girdle and fin. Fin duplications are observed only at a defined dose of RA. Inhibition of RA synthesis by exposure to citral leads to fish which lack pectoral fins but can be rescued by addition of exogenous RA, suggesting that RA signaling is critical to fin specification during early development. The ability to consistently induce multiple fins in a large number of vertebrate embryos should contribute to the understanding of genetic regulation of the normal positioning of limbs during embryogenesis.

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Up-regulation of epidermal growth factor-receptors (EGF-R) by EGF in an HPV-negative cervical cancer cell line

P. Austin Whitlock III, Department of Biology

Overexpression of EGF-R seems to play a critical role in the malignant proliferation of cervical cancer cells. Approximately 90% of cervical cancers are HPV-positive and overexpression of EGF-R is mediated through HPV/E6 protein. However, the status of EGF-R in HPV-negative cervical cancer cells has not been evaluated. HT-3 cells, known to be HPV-negative, were grown in RPMI-1640 medium, with 10% fetal bovine serum for 24 hr. The cells were then cultured in serum-free medium for the next 24 hr., followed by culture in serum supplemented medium alone (medium control), or in the medium containing 0.2, 2.0, 5.0 or 10.0 ng/ml of EGF for another 24 hrs. EGF-R were assessed by a quantitative immunofluorescent antibody assay using an antibody to a recombinant EGF-R protein as the primary antibody.

Compared to controls, a significant step-wise increase in EGF-R were observed until 5 ng/ml concentration of EGF (50.5% increase). However, 10 ng/ml treatment downregulated EGF-R somewhat being significantly lower than 5 ng/ml, but still higher than control. These data suggest that the EGF-R in HT-3 cells respond normally to EGF stimulation and that unstimulated HT-3 cells do not over express EGF-R.

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Building Better Teachers

Sharon Johnson, Department of Physics & Astronomy

The goal of this project was to describe the beliefs and practices of some College of Charleston professors and compare these to traditional beliefs and practices. The teachers were chosen from those participating in the M. Ed. in Math and Science program here at the college. Understanding how teachers teach will allow us to build better programs for training teachers. This study was a spin off of a similar study done by the University if Iowa un cooperation with the US Department of Education. The data from this study will be added to the national database for future research.

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IP management system
The client, MUSC, does not have a centralized system for managing IP addresses, and the primary goal of this software project is to develop an IP management system utilizing a central point of administration and authority. The system can be accessed over the network from any computer connected to the Internet.

There are two main parts of the system -- the front end written in Java, and the back end being an Oracle database.

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**The Etelman Project**

Dirk Aurin, Department of Physics & Astronomy

The scientific goal of this project is to conduct a photometric survey of selected RsCvn-type variable stars: II Pegasus, Lambda Andromeda, and Sigma Geminorum. The light intensity variation at different wavebands during the rotation of these stars is a result of star spotting, or regions of cooler gases on the stellar surface. These stars have been selected as they are part of ongoing spectroscopic research at a Kitt Peak observatory. A short term goal of the project is to map star spotting on these variables, while ultimate aims include modeling structure and energy transfer in stellar surfaces and lower atmospheres. Other objectives include the preparation of The Etelman Observatory in St. Thomas USVI for scientific research, my personal training in both the operation of such a facility and the scientific procedures for conducting astronomical photometric research, and the promotion of the Etelman Observatory as a future research and learning facility.

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**Preliminary Studies of Bacillus subtilis Bacteriophage SPP1**

Adria Holwell and Robert C. Frankis, Jr.
Biology Department

SPP1 is a virulent B. subtilis double-stranded bacteriophage. While a great deal is known about Bacillus subtilis, the details concerning the infection of this organism by SPP1 are very poorly understood. In this study, some of the culture conditions required to optimize the success of infection by SPP1 were defined. In addition, preliminary attempts were made to isolate SPP1 deletion mutants. The goal of future studies will be to use these mutants to define which genes play an important role in host cell infection.

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**Variable B Stars from Hipparcos Data**

Brian Bacon, Adrian Corman, Eric DeSimone, Robert J. Dukes, Jr.
Department of Physics and Astronomy

The Hipparcos Astrometric satellite was operational between its launch in August, 1989 and mission termination in August, 1993. During this time it obtained positions of over 100,000 stars with 0.002 arcsecond accuracy. As a byproduct of the positional measures a number of brightness measures were
obtained of each star. The Hipparcos data was made public in June, 1997. In this paper we report on an analysis of brightness measures of B spectral type stars. Possible B stars which are photometrically variable include Beta Cephei stars, 53 Persei stars, and slowly pulsating B variables. For a selection of B stars identified as a variable of unknown type and/or microvariable we extracted the photometric data from the Hipparcos catalog and examined it for variability by spreadsheet analysis. In this poster we present light curves of some of these variables as well as some results of periodicity analysis. Through this work we hope to identify potential targets for the Four College Consortium Automatic Photometric Telescope located in Southern Arizona.

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**Imaging Spectroscopy Used for Geologic Mapping of the Tintic Mining District, Utah, USA**

Robert Nusbaum, Jeff Nettles, and Steve Stearns
Department of Geology

Moderately vegetated terrain provides a challenge to geologists interested in mapping and mineral exploration. Using data from NASA's Airborne Visible/Infrared Imaging Spectrometer (AVIRIS), we mapped exposures of quartzite and carbonate geologic units at the East Tintic Mining District, Utah. The 1996 AVIRIS data were reduced to scaled surface reflectance. We then determined the inherent dimensionality of the image data using a standard Principal Components transformation of "noise-whitened" data. Extreme spectra were identified through n-dimensional visualization techniques, and used as endmembers for linear spectral unmixing within the 2.0 to 2.45 Åμm spectral range. The resultant endmember maps correspond well with the geologic map published by the U.S. Geological Survey and provide a dramatic improvement over visible and color infrared images.

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**The Nile Delta: Recent Changes and Landsat**

Eileen Duffy and Robert Nusbaum, Department of Geology

The Nile delta is one of the most intensely cultivated areas on Earth, and it is currently facing many problems. The first of these is the increasing erosion that is directly linked to the High Aswan Dam which traps virtually all of the silt which used to replenish the river's banks and fertilize the surrounding area. A second problem is the rising soil salinity that may be attributed to the rising groundwater table, compounded by the delta's rapid subsidence rate, and to the fact that salts are no longer carried away now that the annual floods of the Nile were halted by the High Aswan Dam. The most significant problem facing the delta, however, is the decreasing productivity of the land and the consequent increased dependence on fertilizers and pesticides caused by the desertification of the land due to salinization and by the wasteful agricultural processes that leave many fields waterlogged. We used Landsat data to examine the feasibility of assessing the extent of salt water encroachment on the delta as detected through vegetation differences.

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**Field Survey of Shallow Aquifer Hydraulic Properties in the Charleston South Carolina Region**

Christopher Abate, Kurt J. McCoy, Sean Malley, Brian McCall, Marvin Murdaugh III, Anton Dumars, and
In the Charleston region, hundreds of shallow wells are constructed each year for the purpose of monitoring groundwater quality and to a lesser extent for water supply. These wells may be employed to estimate the critical aquifer hydraulic property, hydraulic conductivity (K). Hydraulic conductivity is a coefficient of proportionality describing the rate at which water can move through a porous media (Fetter, 1994), and can be used to predict the behavior of a subsurface groundwater flow system. Aquifer analysis methods, such as pumping and slug tests, involve a controlled perturbation of the aquifer and monitoring of its response. Time-water level data is collected during this response and used to solve for K via an appropriate interpretation technique.

45 slug tests were performed on 21 wells at 12 different locations and analyzed using the Bouwer and Rice (1976) method to solve for hydraulic conductivity. For each well a geometric mean K of the replicate tests was computed and entered in a database. 42 K values from the literature, unpublished project reports, and personal communications were added to this database along with information on surficial geologic materials, well construction details and other attributes at each site. Summary statistics for the whole population of K values and subsets with common attributes were computed and compared.

The geometric mean of all test results was computed to be 4.52 ft/day with a range from 0.33 to 86.83 ft/day. While this mean is considered representative of the region, the range suggests a high order of spatial variability. As expected, wells completed in coarse fill exhibited high values. Unexpectedly, the single well completed in clay deposits yielded the highest hydraulic conductivity as opposed to the lowest. Also, low values were encountered in limey sand units, suggesting these are finer grained than clean sands. Wells less than 10 feet in depth exhibited conductivities twice as high as deeper wells. This may be related to the observation that College of Charleston test values were generally higher than those of others, and College of Charleston well sites were predominantly shallow.

Remote Sensing and Geographic Information Systems (GIS) Study of Morris Island, SC

Christopher C. Nichols and Steven V. Stearns
Masters in Environmental Studies Program

Remote Sensing and Geographic Information Systems (GIS) will be utilized in an effort to document the significant natural and human-induced change seen on Morris Island, South Carolina. Shoreline retreat over time, the positions of historic archaeological sites, and the current placement of dredged material will be considered. This transgressive barrier island is dynamically moving landward in a series of washover fans where dunes and beach ridges are generally lacking. As a result, in some areas of the island, coastal erosion rates have been in excess of 20 feet per year (ft./yr.) for at least the last 150 years. While Morris Island is deserted today, during the 1860s, it was the site of numerous conflicts between Union and Confederate armies and ironclads. Presently the island displays few obvious remnants of these buildings, fortifications, and burial sites. Beginning in 1969/1970, much of the island has been covered by a dredged material disposal area. To display these effects, a time-series approach will be taken, thus reconstructing the history of Morris Island since the 1850s in a visual and graphical manner. Data to be analyzed include Landsat thematic mapper (TM) and multispectral scanner (MSS) data from 1975-1994, aerial photos from 1949-1979, and historical maps from the 1860s.
Evaluation of SIDD: Simulations in Developmental Disabilities

Mary T. Grady and Marcie Desrochers, Department of Psychology

SIDD: Simulations in Developmental Disabilities, a computer simulation system to teach students behavioral assessment and treatment skills, was empirically evaluated. A paper and pencil version of a behavioral assessment, given as a pre-test, was delivered to experimental and control groups of psychology students in upper-level courses. The experimental group was then exposed to four simulated clients from the software and post-tests were administered. Three evaluators identified whether randomly presented tests were written by students who had received the software. Subjective evaluations of SIDD and pre-post-test evaluation data will be presented.

Reworked Deltaic Sands in South Lake Arthur Field Louisiana: A Model for Exploration

Eric S. Rhoden, Department of Geology

South Lake Arthur Field is a large gas field in south Louisiana with estimated potential reserves in excess of a trillion cubic feet. Because of its economic potential, numerous oil and gas companies have conducted geological investigations in this area. This interest has led to the creation of many different stratigraphic interpretations. Some of these interpretations are very complex, relying on dozens of faults to explain the many variations in sand intervals. One model explains these variations by sedimentary facies changes rather than by faulting (Saxena, 1990).

Data from electrical logs and court transcripts were used to study the "Miogyp" reservoir. The "Miogyp" sandstone interval is Oligocene in age and lies between 16,000 and 18,000 feet below the surface in this field. The sequence comprises four depositional facies, they are: prodelta shale, distributary mouth bar sandstone, reworked deltaic sandstone, and transgressive marine shale. The sequence of interbedded shales and sandstone units along with the characteristic anticlinal structure, create an excellent setting for hydrocarbon accumulation.

The purpose of this study was to better understand and to be able to recognize the depositional sequences that occur in the "Miogyp" interval. Copies of well logs from the field were used to create structural contour maps, isopach maps, and geologic cross sections. A comparison was made between this work and Saxena's model. An understanding of the geologic events that occurred in this field could be useful in future exploration, not just in the Gulf of Mexico, but in similar sedimentary basins around the world.

Hurricane Tracking and Storm Surge Mapping

Craig Anthony, Environmental Studies Program

Demographic trends show significant population growth in the coastal areas of the United States. Property
values are increasing at an alarming rate as a result of a greater demand for waterfront lots. Expensive communities are blanketing the coast and home values are escalating to enormous dollar figures. Every year a disaster strikes somewhere along our nation's coast causing mass destruction and costly clean up. Therefore, as coastal area populations continue to grow, it becomes increasingly important to identify regions that are most vulnerable to disasters so that necessary prevention and damage reduction measures may be taken.

The Hurricane Tracking and Storm Surge Mapping Project, created within a Geographic Information System (GIS), is a tool which will allow state and county officials to identify areas most vulnerable to hurricane storm surge inundation for coastal North Carolina. Storm surge is a damaging dome of water that is pushed onshore as a hurricane approaches the coastline. The dome may stretch 100 miles wide and can easily consume protective barrier islands and low-lying areas. Using the GIS database, storm surge data can be overlayed with demographic data such as population density and median home values. The generated maps allow state officials, county officials, and coastal planners to properly determine which areas are most susceptible to high dollar damages in the event of a hurricane as well as to aid in locating emergency evacuation routes and shelters.

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**Ecotourism in the ACE Basin**

Alicia Sievert and Mary Anne Poole

The South Carolina coast is becoming increasingly popular. As a result many existing environmental problems have been intensified. Our objective is to create an interactive map of the ACE Basin area, which includes a synthesis of information about the ACE Basin to help resource managers deal with the ever-increasing flow of environmental problems arising in the Lowcountry of South Carolina, while creating a navigational aid for the ACE. Data layers will include physical setting, entertainment, ecotourism, lodging, and dining facilities in the ACE Basin area. The interactive map will be used in the ACE Basin Characterization CD-ROM and distributed by South Carolina Parks, Recreation, and Tourism. We plan to go to the ACE Basin and collect data on points of interest using a GPS unit. We may also take pictures of historic locations, which can be incorporated, into ArcView to produce a GIS representation of the ACE Basin.

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**Meteor Imaging Using CCD Photography**

Jeffrey Scott Blair, Department of Physics & Astronomy

The primary goal of this project is to lay the groundwork to begin a student meteor research program at The College of Charleston using CCD imaging as the imaging method of choice. CCD’s offer the ability of digital storage and manipulation not available with other photographic methods. Emphasis will be placed modification of the McKinley Capture Efficiency Equation (Sinnott, Sky and Telescope, Feb. 1994) to incorporate CCD imaging in order to establish a basis for comparison against other photographic methods. The results from this will be an indicator of the CCD's viability as an alternative method of searching for new meteor streams, imaging meteor trails and the determination their radiant point.
Responses of male mountain chickadees to playback do not vary with stage of nesting cycle

Carissa Foster and Arch McCallum
Department of Biology

Members of the avian genus Poecile (chickadees) are territorial during the breeding season. Stefanski's work on the Black-capped Chickadee (P. atricapillus) showed a decrease in territoriality as the nesting season progressed, and McCallum and Bolster showed a decrease in territorial behavior between laying and incubation, and total cessation after fledging, in the Mountain Chickadee (P. gambeli). These results and theory suggest that male chickadees use territorial defense to protect paternity, and predict that responses to song playbacks near the nest should decrease after paternity is settled with the laying of the last egg. We performed standard playbacks of Mountain Chickadee song near the nests of marked males, representing intrusion by the areas's highest ranking male, before and after clutches were completed. Principal Components Analysis summarized 90% of the variation in number of songs in response, total duration of response, and latency to response in a single composite variable. Values were not significantly different for pre-laying, laying, and post-laying tests, suggesting, contrary to the prediction, that males are territorial for other reasons than protecting paternity.

Modelling interspecific differences in chickadee notes with a multiplicative AM model

Cheryl Sine and Arch McCallum
Department of Biology

Studying the evolution of vocal behavior with the comparative method requires the identification of homologous behavioral characters. In the Paridae, an avian family of some 60 species, repertoires are particularly complex in Poecile (the chickadees), including combinatorial chickadee and gargle calls, as well as whistled songs. Note-types are attractive candidates for characters in intra- and intergeneric comparisons, but an objective form of classification is needed to replace conventional subjective techniques. We tested the ability of Nowicki & Capranica's heterodyne AM model to predict the complex overtone structure of naturally occurring chickadee notes. Synthetic notes produced by addition and multiplication of two fundamentals plus their harmonics, representing nonlinear coupling of two syringeal oscillators, agreed well with relatively narrow-band high frequency notes in 8 species, and with some broad-band low frequency notes with multiple overtones. We classified Black-capped Chickadee notes with cluster analysis of Principal Components derived from frequency and time measurements of both fundamentals. Published syntactical relationships were preserved in this objectively defined note set, but phonological distance appears to play a large role in syntax.

Structure of Dawn Serenades in Carolina and Mountain Chickadees

Jason Davis and Arch McCallum
Department of Biology

During the breeding season, several species of chickadees mix whistled songs, chickadee calls, and gargle calls into complex dawn serenades of about 30 min duration. We recorded complete serenades of Carolina (in SC) and Mountain Chickadees (in NM) to test predictions of a mate-attraction hypothesis for the function of dawn song. Carolina Chickadees alternated whistles, gargles, chickadee calls, and variants thereof in a manner suggesting they were tokens of variety. Mountain Chickadees rarely used gargles and
appeared to use chickadees to communicate with their mates (on the nest) and whistles to advertise to neighbors, suggesting that variety is not a signal of quality in this species. Serenades increased in duration (4 of 5 males), and whistles increased in proportion (4 of 5) after Mountain clutches were completed, suggesting that paternity protection is not the only function of dawnsong in this species. Carolina serenades showed much more variety (complexity?) than those of the Mountain Chickadee.

Identification of Teaching Methods

Charles Cockcroft, Department of Physics & Astronomy

I have used three survey instruments to gather data describing the teaching methods and philosophies of mathematics and science teachers at two local high schools and two local middle schools. These schools were chosen for study because they are located in a predominantly rural, low income population. There has been a history of poor outcomes for the students in these schools. I am attempting to tie teacher methodologies and philosophies to the observed student performances. Initial data indicates that teacher centered approaches to education are popular among the teachers at these schools. Current educational theory suggests a more student centered approach produces better results. In the long run this data may help to fine tune teacher preparation programs at our universities.

The Potential for Intrinsic Bioremediation of Petroleum-Impacted Sediments in the Cooper River, Charleston-North Charleston, SC

Jaime Chose and Michelle Novak
Masters of Environmental Studies Program

Historically, the Cooper River near Charleston, South Carolina has been a major thoroughfare with heavy boating traffic to and from local industries. Effluent from these industries as well as boat traffic have contaminated the river water and sediment with various chemicals. Some of the contaminants of concern include petroleum compounds such as naphthalene and phenanthrene. While these are molecules that can cause negative health effects as well as adverse ecological effects, they can be potentially degraded by naturally occurring microbes in the sediment. The breakdown of these compounds contributes to natural attenuation which is the gradual decrease in concentration of the contaminant in the environment. It is important to monitor the concentrations of these contaminants to provide evidence that natural attenuation is occurring. The toxicological profiles of naphthalene and phenanthrene warrant this evaluation.

Mineralization and productivity data from the Navy Research Laboratory were evaluated. By evaluating the mineralization rates of naphthalene and phenanthrene in sediments of the Cooper River, we were able to assess the breakdown and natural removal of these compounds by microorganisms. These data also show the possibility of intrinsic bioremediation. By observing the degradation rates of naphthalene and phenanthrene measured in laboratory, we estimated the efficiency of the microorganisms with respect to their ability to metabolize these compounds. The rates from the sediments samples can be compared among the sample stations. It seems likely that natural attenuation and continued monitoring will allow for adequate cleanup of naphthalene and phenanthrene over time. The locations and concentrations of sediment samples were mapped using Geographical Information System (GIS) to show the spatial relationship of productivity, mineralization rates, and concentration of the naphthalene and phenanthrene.
A Preliminary study of Chromium Concentration in Soils Within Census Tract 45 Using a Geographic Information System

Dianna Alsup and Peter J. Baker
Masters of Environmental Studies Program

Chromium, an EPA Class A human carcinogen, may accumulate in soils near industrial sites. The first step toward the determination of possible health risks associated with Chromium concentrations in soil in the vicinity of the industrial sites. Ten soil samples were collected from ten locations in the small neighborhoods found in the areas of the Enterprise Community known as Four-Mile/Hibernion of Charleston/North Charleston (Census tract 45). Chromium concentration in these soil samples will be compared to EPAs Resource Conservation Recovery Act (RCRA) action levels. The data collection points are presented using GIS mapping to indicate the chromium concentration distribution in Four-Mile/Hibernion. Results from this investigation will be an initial step to evaluate the potential risk associated with chromium in soil.

All soil samples were taken 5 feet from the edge of roadways. Samples were extracted from soils using an auger, and sampling depth ranged from 2 inches to 7.5 inches. Chromium was acid-extracted from the samples following EPA method 200.3 and measured using EPA method 200.7 for ICP-atomic emission spectroscopy. Chromium concentrations in soils ranged from 8.4 mg/kg dry soil to 332.7 mg/kg dry soil, but all values are below USEPA Suggested Soil Screening Levels (SSL). ArcView 3.0a and data layers from the SC Department of Natural Resources will be used to construct an area map containing collected soil chromium concentration data.

Evaluation of Environmental Justice Programs Within the Enterprise Community of Charleston, SC

Alex E. Griffin and J. O’Neil Johnson III
Masters of Environmental Studies Program

Industries use several approaches to address issues of community outreach. Among these issues include environmental justice, which has developed into an issue in the past several years. Environmental justice is the argument that environmental problems occur more often in minority and low income communities because of the lack of power and voice within the community. With increasing awareness, President Clinton established the 1994 Executive Order which required industry consideration of environmental justice issues. Industry has become aware of the need to develop such programs and become more involved with the surrounding community. In Charleston, the Community-Based Environmental Protection (CBEP) Advisory Group was formed to bring industry and the community together in order to deal with issues regarding the area.

The Enterprise Community of Charleston/North Charleston consists of a heavily industrialized area spotted with neighborhoods that in some cases border the industrial property boundaries. The approach taken in conducting this study was to first interview the environmental managers/coordinators (and sometimes public relations directors) to determine what, if any, community outreach programs were in place. The industries participating in the study were Albright and Wilson Americas, Inc., Allied Terminal, Macalloy, Inc., and Westvaco Corporation. In addition, an interview was conducted with an official from S.C. DHEC to determine the approach of the state government to address environmental justice issues. These interviews led to an evaluation of the various programs. Included in the evaluation was an analysis of the advantages and disadvantages of each program, a comparison of the programs, and a determination of the effectiveness
of each program. With this evaluation, recommendations were developed that can be used to aid new industry moving into the enterprise community.

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**The Northern Enterprise Community Rail With Trail System: Guidelines for Creating a Trail System Through the Enterprise Community**

Mark W. Jansen and James W. Daugomah
Masters of Environmental Studies Program

This proposal will introduce a rail with trail plan within the CSX/Norfolk Southern railroad corridor to provide safe pedestrian access to the northern Enterprise Communities (ECs) in the Charleston neck area. This region of town supports many large industries and thus experiences a high volume of automobile and truck traffic. The proposed plan will include trails, trail accesses, and greenspaces connecting the various neighborhoods and linking residential, commercial, and recreational destinations. The trail system would be bounded by King and Meeting Streets and would extend approximately two miles from Mount Pleasant Street to Hackerman Drive in the Union Heights area. The City of Charleston has identified the need to provide these residents with a safe non-motorized travel alternatives while beautifying a severely neglected and overgrown area subject to intermittent crime, vandalism, and general blight.

Residential concentrations were identified by researching Charleston County tax maps and records. An on-site assessment of the study area was conducted and evaluated for possible trail placement and trail access locations. Issues of accessibility, security, and appearance were considered and factored into the trail design. Trail system costs are estimated to illustrate the capital resources needed for project implementation and may vary based upon future design modifications or additions. After initial planning and design, additional detailed development guidelines and engineering will need to take place after completion of this plan. The specific location and design parameters of trails and trail accesses within this railroad corridor will be completed in subsequent project planning efforts by the appropriate City or County agency. The preferred trail system, while quite specific in this plan may be modified and expanded northward into the North Charleston area connecting other ECs such as Accabee as resources and additional experience becomes available.

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**Wind Patterns on Peninsular Charleston: Implications for Airborne Contaminant Dispersal in the Enterprise Community**

James R. Frysinger
Master of Science in Environmental Studies Program

The coastal geography of Charleston, SC strongly affects the seasonal and diurnal wind patterns, air temperatures, and precipitation near the coast and thus affect the dispersal and washout of airborne contamination. Yet, the weather forecasting for this area is performed by the Weather Service Office in Columbia, SC and normally reflects the synoptic weather expected for the midlands, relatively unaffected by the coastal effects. The most significant and the most localized of these coastal effects is the sea breeze generated by differences in temperature between the cooler ocean and the warmer inland air mass.

Historical data for Charleston, SC were analyzed for the period 1945-1990. Generally, the underlying wind pattern is characterized by geostrophic winds from either NNE or SSW, running essentially parallel to the coast. These are fairly weak in most months but seasonal and diurnal effects overlie them, as shown by this analysis. Late spring and early summer see the formation of sea breezes, which push inland during the
afternoon and often form fronts with the inland air mass. This can lead to inland deposition of air pollution produced on the coast or transport up and offshore above the sea breeze layer, depending on factors presented here. Improvement in the ability to predict sea breezes is needed to predict the transport and deposition of air contaminants.

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Brownfield Redevelopment in the Enterprise Community: A Case Study

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The use of brownfields redevelopment policies provide an innovative opportunity to clean up contaminated sites while stimulating economic growth and revitalization of urban communities like the Enterprise Community (EC) of North Charleston, SC. The Environmental Protection Agency (EPA) has defined brownfields as "abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination." Developers are reluctant to purchase former industrial sites in the EC due to the potentially significant liability and remediation provisions mandated under the 1980 Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). In 1995, the EPA announced its Brownfields Action Agenda which set out to clarify and limit liability in order to promote brownfields redevelopment. Several states, including SC, have followed the EPAs guidelines in establishing voluntary cleanup programs which offer various incentives at the state level. The goal of our project was to locate a site in the EC that would be a suitable candidate for brownfields redevelopment under the states voluntary cleanup program. The former Pacific Guano Fertilizer plant, currently owned by AmeriSource, was chosen as a potential brownfield site due to its size, location, access to transportation, and the availability of environmental data. This ten acre site is located between I-26 and King Street Extension. Since the 1870s, at least five phosphate fertilizer plants have been located on this property. Numerous environmental assessments have been conducted since 1992 due to a desire to sell the property. The latest assessment in 1995 found lead (Pb) to be the contaminant of concern in the soil. Concentrations ranged from 130 to 7300 ppm, with six of the soil samples above the EPAs soil cleanup range of 750-1750 ppm for industrial sites. Concentrations of arsenic and mercury (Hg) were below the EPAs soil screening level. In the groundwater, Pb, Hg, and nitrates were below the EPAs drinking water standard.

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A Land-Use Approach to Mitigating Industrial Impacts on Residential Areas in the Charleston Enterprise Community

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In an area such as the Charleston Enterprise Community, where residential and industrial land uses often occur immediately adjacent to each other, priority conflicts would seem inevitable. Understandably, residents are concerned about the effects that industrial activity has on their ability to maintain a reasonable standard of living within their communities. In order to address the residents' concerns, we examined the results of surveys conducted by the N.E.W. Fund of the Trident Community Foundation and selected the issues that might be addressed through land-use measures. These are: appearance, dust and noise as a result of industrial activity, lack of adequate recreational space, better public transportation, and a supermarket within a reasonable distance. Based upon these issues, we have devised a hypothetical land use plan that will attempt to mitigate the impact of industrial activity and improve the quality of life for residents in the neighborhoods of Rosemont, Silver Hill/Magnolia, and Four-Mile/Hibernian.
The land use plan was generated from data provided by the Harmony Project and the N.E.W. Fund. It employs the following features: sound attenuation walls to deflect traffic noise from I-26; vegetative buffers to control airborne dust and provide a barrier to sound; and community parks and gardens to provide social and recreational opportunities, improve appearances, as well as enhance the neighborhoods' sense of community. We also included the following larger-scale initiatives: the strategic relocation of certain commercial operations around Silver Hill/Magnolia to provide buffer zones between community and industry; the development of a waterfront park with boat access within a portion of the former Koppers Superfund site; the relocation of Four Mile/Hibernian into vacant land just north of the Rosemont neighborhood; and the siting of a shopping center and a small business incubator at locations accessible to residents. We review various methods of land acquisition, potential incentives for the relocation of industry, as well as innovative approaches to traditional zoning that could be employed within the Enterprise Community to reduce the potential impact of new industry on existing residential areas.

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Development History of the Enterprise Community Using Aerial Photography

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The northern portion of the City of Charleston is part of a HUD designated Enterprise Community (EC). This region has a long history of industrial and residential occupation. The proportion and proximity of industry to residential zones has changed over time. Today, a number of small neighborhoods are completely surrounded by dense industrialization. Quality of life in the neighborhoods has been impacted by pollution, increased noise levels and constant vehicle traffic. Aerial photographs provide chronological documentation of the history and progress of development within the Enterprise Community. Photos were scanned at 400 dots per inch (dpi) resolution and edge-matched using computer software.

Despite physical changes to the landscape over the years, the neighborhoods that comprise the EC remain, as a whole, a close-knit conglomeration of communities. To fully understand this, it is necessary to travel back in history. From the arrival of the earliest settlers through to the present day, a rich historical lineage connects these families to this region.

Many problems now face these communities, economically, socially, and environmentally. However, the social fiber that binds these communities remains strong. This fact, coupled with progressive governmental programs, such as the new CBEP initiative, may lead to a much brighter future for this historically rich area.

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Re-Use Analysis for the Former Navy Tank Farm Located in the Chicora Neighborhood of North Charleston

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With the recent closure of the Charleston Naval Base in 1996, over 2800 acres of property became available for potential re-use. The Chicora Tank Farm, located on a 23.8 acre parcel approximately 500 yards west of the base, provided fuel and lubricants storage for the Naval Base from 1943 until 1996. Re-use options for this property were evaluated based on factors of decommissioning and property conveyance methods, environmental concerns and legal requirements, and funding mechanisms. In addition, the desires of stakeholders, general cost-benefits, and spatial assessments of the adjacent neighborhood were considered.
Environmental concerns have been addressed, and the property is inherently safe for re-use.

While industrial-commercial alternatives offer benefits and are safe options for re-use, evaluation of the above factors indicate that the most suitable re-use of the property includes a mixture of recreational and educational functions. Previous environmental assessments have indicated this re-use option is a safe alternative. Additional benefits would be obtained by managing this property as a buffer zone between the residential-educational areas and the industrial-commercial areas.

Identifying Sources of Lead Exposure in Children Residing in Census Tract 44: The Relationship Between Soil Lead and Blood Lead Concentrations

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Lead exposure in children is a serious concern in many communities, and testing of all children aged 1 to 5 is recommended by the Center for Disease Control. Children, whose defense mechanisms and immune systems are still developing, are more susceptible to lead poisoning and experience IQ deficits at blood lead levels of 10 micrograms/dL. The primary source of lead exposure is dust and chips from lead-based paint used in housing prior to 1970. Steps have been taken to significantly reduce lead dust in homes, including banning lead-based paint and educating parents on ways to reduce household exposure. Children may also be exposed to lead found in the soil, although little is known about the relationship between soil lead levels and blood lead concentrations found in children. Sources for lead in soil include exterior house paint, former underground leaded gas storage tanks, and industry.

Census tract 44, which includes the Magnolia, Rosemont, and Silver Hill neighborhoods, is located in a historically industrialized area. This tract includes 23 sites with reported leaking underground gas tanks, and a Superfund site where high levels of lead have been found in the soil. Also, 70-80 percent of the housing in these neighborhoods was constructed before 1970. Therefore, it is possible that children in census tract 44 are exposed to lead in the soil in addition to indoor exposure. Lead concentrations from soil samples were compared with lead concentrations in blood samples from children to determine whether children living in areas with high lead levels in the soil have higher levels of lead in the blood than children living on less contaminated soil. Existing data from venipuncture sampling in children and a soil survey study were grouped by street and regression analysis performed. Results showed a statistically significant relationship between lead in soil and blood lead levels (p<0.001). However, there are many factors which influence blood lead levels, including nutritional status and indoor exposure, that must be considered before conclusions are made.

An Assessment fo Risks From Inhalation Exposure Due to Air Emissions From Albright & Wilson, Americas In Charleston, SC

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Inhalation risks from industrial emissions are of concern to the people living in the Enterprise Community in Charleston, SC. One of the major industries in the Enterprise Community, defined as census tract 44 and 45, is Albright & Wilson Americas. A risk assessment was conducted to determine whether or not people living in nearby neighborhoods are at risk from inhalation exposure of air emissions from Albright & Wilson. Risk assessment calculation were performed using air quality data reported to SCDHEC, consistent
with air permitting requirements. These data provided a conservative estimate of risks, which allowed for a worst case scenario risk assessment. These data are conservative because they are based on maximum capacity output. The concentration of the emissions at the primary receptor, the Rosemont neighborhood, was determined by the Gaussian plume dispersion model. Meteorological data required for the modeling was obtained from the National Weather Service. Toxicological and risk information was obtained through the Integrated Risk Information System (IRIS) and other references of toxicological data. The exposure assessment and risk assessment calculations were done using EPA-approved methods. A level of risk greater than one in one million (1.00E-06) is considered an increased risk to the residents of the Rosemont community. The results of this study will be communicated to the residents of the Enterprise Community.

Of the nineteen chemicals that are emitted from Albright & Wilson stacks (epichlorhydron, ethyl chloride, ethyl dichloride, ethylene oxide, methanol, methyl bromide, methyl chloride, phenol, propylene dichloride, propylene oxide, chloromethane, phosphoric acid, hydrogen sulfide, phosphorus acid, hydrochloric acid, formaldehyde, ethylene dichloride), three are listed as carcinogens by the IRIS database (epichlorohydron, propylene oxide, and formaldehyde). Using a direct wind path for a conservative estimate of the concentration of the chemicals of interest to the Rosemont neighborhood, the exposure estimate was also conservative. Using conservative methods, the risk assessment indicates that the people living in the Rosemont neighborhood have a 1.01E-06 (1.01 in one million) risk of cancer due to inhalation exposure to air emissions from Albright & Wilson.

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An Evaluation of Hexavalent Chromium NPDES Permit Violations On Shipyard Creek

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The Clean Water Act (CWA) was initially designed to restore and maintain the integrity and beauty of the nation's waters. In 1987 congress amended the CWA to require the implementation of a comprehensive approach for addressing storm water discharges under the National Pollution Discharge Elimination System (NPDES). NPDES permits are the primary means to regulate point source pollutants into water systems. It has long been recognized that storm water from industrial lands can pose a threat to surface waters by changing the natural hydrological patterns and elevating concentrations of pollutants in nearby watersheds. The water quality act of 1987 initiated the NPDES Phase I program which regulates storm water discharge associated with industrial activity.

Macalloy Inc., a chromium alloy facility located in the Enterprise Community, falls under the Phase I program and is required to obtain NPDES permits for point source pollutants. Macalloy has several outfalls that are regulated by NPDES permits and discharge into Shipyard Creek. This creek is a tidal controlled creek that feeds into the Cooper River. This project will characterize any NPDES discharge violations spanning January 1989 through January 1997 and present a hypothetical fate and transport model for hexavalent chromium.

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Geochemical Mapping of Transition Metals in Residential Soil Adjacent to Industries, Charleston-North Charleston, SC

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Soils at or near industrial sites frequently show concentrations of transition metals (V, Cr, Co, Ni, Cu, Zn, Cd, Pb) that are elevated relative to pre-industrial background concentrations. Characterizing the distribution and magnitude of metals in soils is the first step toward a human health risk assessment, given adequate sample density. Residential soil sample analyses (n=47) from the Rosemont and Silver/Hill Magnolia neighborhoods in Charleston-North Charleston (census tract 44) were interpreted using GIS mapping methods to determine whether the pattern of metal concentrations reflect sources of known metals contamination. Rosemont and Silver Hill/Magnolia are small (approx. 132 acres total) residential areas adjacent to existing and former industrial facilities (chemical manufacturing, oil recycling, fertilizer processing), a federal NPL site (Koppers, Inc. SCD980310234), several CERCLIS sites, an interstate roadway, and railroad freight line. The Rosemont and Silver Hill/Magnolia neighborhoods are part of a larger area that encompasses census tracts 44 and 45, which has been designated by HUD as an Enterprise Zone. Results from this investigation will be communicated to the residents during their community meetings.

Metals were acid-extracted from sieved (< 2 mm), surface (top 5 cm) soil samples using EPA method 200.3, and measured using EPA method 200.7 for ICP-atomic emission spectroscopy. Metals concentrations for Rosemont and Silver Hill/Magnolia residential soils range as follows: V, below detect to 43 mg/kg dry soil; Cr, below detect to 186; Co, 3.8 to 14.0; Ni, 0.4 to 31.6; Cu, 0.4 to 16.4; Zn, 38 to 2,140; Cd, below detect to 7.0; Pb, 59 to 3,720. Metals concentrations in some of these soil samples exceed EPA RCRA action levels, although any decision about remediation alternative will require development of risk-based soils screening level concentrations. These data will be imported into ArcView 3.0 to construct neighborhood maps showing the magnitude and distribution of transition metals.

The Potential Impact of Contamination from Storage Tank Sites in the Enterprise Community

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The purpose of this project is to illustrate the potential impact of contamination from storage tank sites on the residential neighborhoods and environment of the Enterprise Community. The continuous circulation of water from surface water bodies through the atmosphere to the land surface and back to surface water bodies is called the hydrologic cycle (Monroe and Wicander, 1995). Groundwater is the water held in pore spaces within rocks and unconsolidated sediments. Aquifers are layers of rock or sediment that contain and transmit groundwater. In a coastal environment such as the Charleston area, shallow groundwater tends to move laterally from landmasses toward surface water bodies (Park, 1985). Groundwater serves as an agent of transport for soluble and insoluble contaminants. These contaminants influence subsurface and surface water quality which, in turn, impacts human health and the environment.

This project is composed of two basic parts: a map of the storage tank sites and a map of the groundwater flow in the upper flow zone of the shallowest aquifer on the peninsula. A data layer containing the geographic locations of contaminated storage tank sites, their site descriptions, the type of tank, and the site identification number was acquired from the South Carolina Department of Health and Environmental Control (SCDHEC). The geographic locations were initially determined by SCDHEC using a Global Positioning System and were then modified based on site visits. Additional data on the location and contamination associated with each site was gathered from SCDHEC's Freedom of Information (FOI) office. The data layer is displayed graphically through ArcView 3.0, a computer-based geographic information system (GIS) developed by Environmental Systems Research Institute, Inc. (ESRI). The map of groundwater flow is a product of the numerical simulation of groundwater flow in the shallowest aquifer. A numerical simulation defines the likely patterns of groundwater flow by integrating data with assumptions regarding climate, physical geology, and aquifer properties. The 1996 version of the U.S. Geological Survey Modular Finite Difference Groundwater Flow Model (MODFLOW) was used to numerically simulate this...
aquifer system (McDonald and Harbaugh, 1988). The Department of Defense Groundwater Modeling System (GMS) was utilized to prepare the input data for MODFLOW and to analyze the output.

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Comparison of the EPA Proposed Cleanup Plan for the Former Koppers Site in Charleston, SC with the Records of Decision for the American Creosote Works Site in Pensacola, FL and Bayou Bonfouca Site in Slidell, LA

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Masters in Environmental Studies Program

Two Environmental Protection Agency (EPA) Superfund Records of Decision (ROD) and a proposed remedial action from three creosote wood treating operations were analyzed and compared on the basis of consistency in the remedial alternative selection process. The sites were selected with regard to similarities in the type of on-site operations performed, proximity to important water bodies, proximity to moderately dense commercial and residential districts, geologic setting, and contaminants of concern. The sites addressed in the RODs were American Creosote Works in Pensacola, FL, and Bayou Bonfouca in Slidell, LA. The proposed cleanup plan for the Koppers site in Charleston, SC will be evaluated on the methodologies used in identification of cleanup alternatives at Slidell and Pensacola. The importance of this review is to ensure the proposed remedial action and process used in its selection is consistent with previously issued RODs of similar nature.

Data to be analyzed will include documentation on the selection of cleanup alternatives for soils contaminated with polynuclear aromatic hydrocarbons (PAHs). Specific issues addressed will be the risk assessment criteria, level of contaminants, remediation alternatives considered, and evaluation criteria for selection of the final clean-up alternative. It is hoped the results of this analysis will identify consistencies or inconsistencies in the EPAs Superfund RODs process.

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The Dynamo Theory: A Stastical Study of Intrinsic Stellar Parameters

Rob Smith, Department of Physics & Astronomy

To determine which stellar properties play an important role in the dynamo process all published information on two stellar properties, magnetic fill factor and observed magnetic field strength, will be used in a statistical analysis comparing these properties to other intrinsic stellar parameters. Parameters of comparison are: individual rotation rates and rotation velocities, the Rossby number of each star, the convective turn-over time, the convective velocity, surface temperature, mass, and stellar spectra as well as stellar classification. As the analysis progresses, other parameters may be included as they present themselves. A careful analysis of the data should indicate which properties play a role in and have an influence on the Dynamo process.

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Early Detection of Crop Stress on Limited Resource Farms Using Unmanned Aerial Vehicles

Michael Moeller and Cassandra Coombs, Dept. of Geology
The primary goal of this project is to develop a cost-effective means of previsual crop stress detection. Work to date by Dr. Gregory Carter of NASA's Stennis Space Center has shown that it is possible to detect signs of crop stress previsually in the near-infrared portion of the spectrum (695-700 nm) up to 16 days prior to visual evidence. Once stress is detected in the visible range of the spectrum, the damage generally is too advanced for corrective measures. Using the results of Dr. Carter's work, we are mounting a digital monochrome camera fitted with a narrow-waveband filter (10 nm, centered at 694 nm) in the fuselage of an unmanned aerial vehicle. The aircraft, a Senior Telemaster, has an 8-foot flat-bottomed wing with high loading, which will allow for maximum stability at slow speeds. In addition to the still camera, a digital video camera is also mounted in the fuselage. Images from this camera are transmitted to a receiver/monitor on the ground, and are used to assist in aligning the still camera images. In addition to these two units, an on-board Global Positioning System (GPS) unit will be installed to test the effectiveness of gathering real-time location data for each flight.

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Seasonal Variability of Pore Density in *Orbulina universa*

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Department of Geology

Planktonic foraminifera have long been used as important indicators for interpreting the paleoecologic and biostratigraphic record based on fossil specimens deposited in marine sediments. Knowing more about the effects of seasonal variability on test morphology in foraminifera can give us a better understanding of past environmental conditions. *Orbulina universa* is a spinose foraminifera that ranges from polar to equatorial regions. A PARAFLUX Mark VII sediment trap was used to collect samples for this study. The trap was moored for one year (June '93 to June '94) at a depth of approximately 3,300 meters off the northwest coast of Africa. The trap collected twenty-one continuous time-series samples, each with a duration of 17.35 days,10 of which were used for this study. The sea surface temperature in the study region ranged between 20-28 °C and an average thermocline depth varied between 30-50 meters. Shell diameter, weight, pore density, pore diameters, and test thickness were measured on average representative samples of *Orbulina universa*. The data were statistically analyzed and compared to factors such as flux, sea surface temperature, and thermocline depth to find any possible relation between these variables.

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Up-regulation of EGF-receptors (EGF-R) by nicotine in a cervical cancer cell line (HT-3)

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Over-expression of EGF-R seems to play a critical role in the malignant proliferation of cervical cancer cells. Smoking is associated with increased relative risk of cervical cancer, with nicotine considered a co-carcinogen. Whether EGF-receptor is up-regulated by nicotine in cervical cancer cells is not known. The
study aim was to determine if nicotine up-regulates EGF-R in HT-3. HT-3 cells were plated on cover slips, cultured in RPMI-1640 medium with 10% fetal bovine serum for 24 hr., placed in serum-free medium for another 24 hr, and then exposed for 24 hr. to culture medium (control), 5 ng/ml or 500 ng/ml of nicotine; These simulate nicotine concentrations in serum and cervical mucus, respectively, of smokers. EGF-R were assessed by a quantitative immunofluorescent antibody assay using an antibody to a recombinant EGF-R protein as the primary antibody.

Nicotine, at both concentrations, significantly up-regulated EGF-R vs. control (31 and 55%, respectively). Our results suggest that the co-carcinogenic effect of nicotine may be partially mediated by up-regulation of EGF-receptors on cervical cells.

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Drugs and Alcohol at the College of Charleston

Math 104 group and Dinesh G. Sarvate
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To study the use of drugs and alcohol at the College of College, our class section conducted a survey. With the information from this survey, we were able to make several different conclusions. These conclusions were then used to construct several different statistical graphs. These graphs will allow anyone to easily see the information gathered from the survey. The main objective is to use different statistical methods to present large amounts of information in an easy to understand manner.

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An Assessment of Safety on the College of Charleston Campus using GIS Technology

Jennifer Guelfo, Erik van der Horst, and Brett Davis
Department of Geology

In recent years as crime has become more prevalent in our society, safety is a rising concern. As students, one of our major concerns is the safety of our campus. With the increase in independence that students obtain when they begin a college or university, a detailed safety assessment is necessary for student, parental and institutional concerns. In light of this, a comprehensive analysis of the safety at the College of Charleston is critical. The Department of Public Safety at the College of Charleston has detailed incident reports of all crimes on campus, extending back many years. However, they lack the resources to compile this information to discover the strengths and weaknesses of their present safety strategies. Realizing this, we propose to create a Geographic Information System (GIS) which will organize, and display this information. This will have many benefits. Parents will be informed of the safety of their child's campus. It will also provide a means for students to avoid problematic areas, and finally, it will allow for campus officials to focus their efforts on areas of need and to see where their efforts have already paid off.