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Remote 3-D Mapping of Lassen Volcanic Center, California

Turgeon, D.H., and Nusbaum, R.L., Department of Geology and Environmental Geosciences

Lassen Peak is one of two Cascade volcanoes to erupt during the twentieth century. Eruptions from 1914 to 1917 produced numerous small phreatic explosions, a pyroclastic flow, and viscous dacite lava near the summit, which mixed with snow and triggered lahars. Earlier episodes of volcanism include the development of silicic domes at Chaos Crags (1,100 to 1,000 yr ago) followed by dome collapse (Chaos Jumbles). Fumarolic activity at several sites continues near Lassen Peak.

We used MODIS/ASTER (MASTER) airborne simulator data to map the distribution of the above volcanic features. False-color RGB images generated using channels 0.58 mm, 1.78 mm, 4.93 mm, respectively, along with results from a minimum noise fraction transformation were used to develop 2-D images of volcanic features. These were subsequently co-registered and "draped" over a 10 m USGS digital elevation model to produce 3-D imagery that can be rotated for enhanced volcanic hazards assessment.

2

Component Based Software Engineering

Lee Baybo, Jonathon LaRoy, J.Hunter Allred, and Wendy Smith, Department of Computer Science

Component-Based Software Engineering (CBSE) emphasizes assembling or reusing components rather than programming an entire software system from scratch. Current software development processes do not lend themselves to component-based approaches. The development cycle for compositional approaches is different than those used for creational software development projects. New steps must be added to the lifecycle process, such as finding appropriate components that reasonably match the requirements and assembling them together with the needed "glue code" to make a functioning system. When CBSE approaches are used the development time and cost can be greatly reduced, if the components meet the specified requirements. There are different types of components to choose from, which vary in the size and services they provide. This poster provides the definition of a component, and some of the implications of using components in a software system. Finally, the different component models, such as CORBA and JavaBeans are briefly examined.
No Reduction in Fecundity Detected in Populations of Genetically Diverse Physa

Department of Biology

Physa, a genus of invasive freshwater pulmonate snails, is among the most common and widely-distributed group of mollusks in the United States. More than 40 species are recognized, many of which are classified according to minor facets of shell morphology. It is suspected that there may only be a few biological species, demonstrating significant amounts of reproductive isolation when outcrossed. As part of a larger ongoing experiment, four populations of Physa were collected for breeding experiments. Three have a type B penis: Physa gyina gyrina from Council Bluffs, Iowa; Physa gyrina aurea from Hot Springs, Virginia; and Physa microstriata from Fish Lake Utah. The last population, Physa acuta from Charleston, South Carolina, is considered a negative control since it has a type C penis. The four incross controls varied significantly in age at first reproduction and 150 day fecundity. Measures of fecundity in the GM and GV hybrids were not significantly different from incross controls. VC hybrid fecundity was significantly below the C control, but not significantly different from the V control. Therefore, we detect no evidence of reproductive isolation among the four Physa populations by these two criteria.

Subsurface Mapping Using 3-D Seismic Data, Gulf of Mexico (Part 1)

Russ Willis, Mike Johnson, and Robert Nusbaum, Department of Geology and Environmental Geosciences

Modern exploration for subsurface natural gas and oil reservoirs requires the use of 3-D seismic data. In this study, a seismic data set collected from offshore of Louisiana was analyzed using 3-D seismic interpretation software. A number of well logs were also used to identify "pay zones", usually characterized as sandy units with high electrical resistivity. Key horizons were mapped to obtain knowledge about the structural characteristics found below the surface of this area. Major subsurface faults and structures were identified and mapped beginning near the surface and incrementally extending to greater depths. The results were combined with isopach maps to identify potentially viable, yet undiscovered natural gas reservoirs.

Software Engineering for Artificial Intelligence Projects

Chip Seitter, Nisha Sheth, Alex Strehl, Sue Tseng, and Chris Wagner, Department of Computer Science

There are many popular software engineering models used to aid in the successful completion of software projects. Most models do not take into account the problems caused by the inclusion of artificial intelligence in the software project. This paper discusses four major areas of artificial intelligence and the effect of each area on the common areas of software engineering.
Standards Development for Agent-Based Software

Dawson Bessinger, John Godwin, Cyrus Shealy, Scott Simon, and Sagi Zakin, Department of Computer Science

This paper introduces the concept of software agents and the Foundation for Intelligent Physical Agents (FIPA). The concept of an agent is important in both Artificial Intelligence (AI) and mainstream computer science. Agent architecture can be thought of as software engineering models of agents; researchers in this area are primarily concerned with the problem of designing software or hardware systems that will satisfy the properties specified by agent theorists. Autonomous agents are increasingly being deployed in complex applications where they are required to act rationally in response to uncertain and unpredictable events. A key feature of this rationality is the ability of agents to coordinate their interactions. FIPA is an international non-profit association of companies and organizations that agree to share efforts to produce specifications of generic agent technologies. These specifications provide the foundational underpinnings which allow the interoperation of agents written by various developers and running on heterogeneous platforms.

Formal Methods for Software Engineering

Chris Graffeo, Tarsem Purewal, Brenden Rudnick, and Maggie Shortridge, Department of Computer Science

Formal methods are becoming more mainstream as engineers realize the advantages and cost-effectiveness of their use in software development. In addition to formalizing software specifications, formal methods allow a software developer to validate the integrity of a software system. Two particular formal methods are of interest to the software developer - algebraic specification and Z-notation. Algebraic specification provides a means to mathematically implement the specifications of a program and integrate these formal specifications into the program development. Similarly, Z-notation allows the developer to prove the correctness of a software design and reason about its behavior through the use of mathematical types, relations and schemas. These methods are only two examples of the many formal methods in use today. Graph-based formal methods offer many of the advantages of conventional formal methods and provide a visual aid to assist developers in understanding software design. Developers of safety-critical systems typically use some type of formal method in the development of their software, however, the use of formal methods is slowly crossing over into the development of non-critical software as well.

Distributed Software Development Model and Tools

Joe Gover, Jim Moore, Manuel Moyer, Tim Scarborough, and Mikell Stevens, Department of Computer Science
The shift towards a global economy, along with the shortage of software development expertise, presents new opportunities to software developers. Today's software projects are no longer constrained by the requirement to have the developers collocated in a physical work space; it is becoming more common for the developers to be geographically dispersed.

This paper describes the distributed software development model and its inherent advantages and disadvantages. The tools utilized in a distributed software development project are explained, as well as the specific topic of open source development with respect to the Free Software Foundation, GNU, GNOME, and the General Public License. The importance of project management and the negative effects of poor project management are detailed. Furthermore, the economic aspects of open source development are discussed, with a concentration on the possible streams of revenue available to an open source developer.

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**Web Services**

Drew Connelly, Terry Helems, John McAliley, Walker Phillips, and Paul Buhler, Computer Science Department

This paper compares Microsoft's .NET platform and Sun's J2EE standard. The comparison will include a description of exactly what .NET and J2EE are, what their common purpose is, and how they accomplish their goals. Also included is a discussion of the similarities between the two, including their use of XML as a means of communication as well as their use of common API's for development. Likewise the numerous differences in their implementations will be explored, including but not limited to their language support and platform dependencies. Finally we will discuss what the advent of these two platforms means for the software engineering community, who is likely to use them, and some predictions for their future success.

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**Subsurface Mapping Using 3-D Seismic Data, Gulf of Mexico (Part 2)**

David Gorney, Mike Johnson, and Robert Nusbaum, Department of Geology and Environmental Geosciences

Exploration of the subsurface in offshore Louisiana, Gulf of Mexico, was conducted by analysis of 3D seismic and well log data. Horizons were mapped at various depths ranging from 3000 to 9000 feet using Kingdom Suite 3D seismic software. The subsurface was found to be characterized by numerous normal listric faults typical of fluvio-deltaic stratigraphic sequences. Faults and structures revealed by the seismic data were then correlated with known pay sands in the well logs in an attempt to locate possible areas of natural gas production.

### 11

**Assesment of iNOS production in Systemic Lupus Erythematosus (SLE) Patient Sera**
Systemic lupus erythematosus (SLE) is a chronic, autoimmune syndrome. Nitric oxide (NO) overproduction has been correlated with SLE disease activity. NO is a short-lived cell mediator, which functions as an inflammatory mediator within the immune system. When upregulated by certain cytokines, inducible nitric oxide synthase (iNOS) stimulates the release of NO. Elevated iNOS levels then, as indicators of NO production, may provide a link to disease pathogenesis in lupus patients. To test this hypothesis, we examined iNOS production in murine macrophage cells (J774s) and peripheral blood mononuclear (PBMC) human patient cells, both stimulated by the cytokine interferon a and lipopolysaccharides (LPS) in lupus patient serum, control serum, and 10% fetal bovine serum (FBS). In the murine cell line, elevated levels of iNOS were found in patient serum, FBS, and control serum stimulated cells. Patient serum stimulated murine cells demonstrated the highest iNOS increase compared to unstimulated cells. Lupus patient PBMCs, stimulated by the aforementioned serum and cytokine + LPS combinations, did not show significant iNOS elevation as opposed to unstimulated samples. In conclusion, iNOS production can be induced in murine cells under cytokine + LPS serum stimulation. At this time, however, increased or induced iNOS production in patient PBMCs has not been directly linked with cytokine + LPS stimulation in patient, control, or fetal bovine serum.

The origins of sterility in experimentally hybridized populations of freshwater snails

Tommy McCullough, Charles Earhardt, Robert Dillon, and Amy Wethington, Department of Biology

Four species of Physa were bred and cross-bred in a laboratory setting to assess the effects of hybridization on fecundity. The snails were bred in pairs to producing a greater likelihood of out-crossing. Physa gyrina aurea (Viginia) were crossed with Physa acuta (Charleston). Physa microstriata (Utah) were crossed with Physa gyrina gyrina (Iowa). Pure bred lines of each species were kept, as well. The F1 generations were crossed and monitored until they produced viable F2 snails. The F1 parents were then frozen and preserved. They were then checked for genetic similarity through electrophoresis. Although one of the crosses proved to have been a pure bred line with no out-crossing, the rest showed good genetic variation and no reduction in fecundity.

Linear Codes Through Latin Squares

Alexander L. Strehl, Mathematics

It is known that mutually orthogonal latin squares of order n generate an error-correcting code with n² codewords. For this project, we consider latin squares of order n made up of elements taken from Z_n = {0,1,2,...,n-1}. We present necessary and sufficient conditions on the latin squares and obtain a method of constructing a maximal family of mutually orthogonal latin squares that form linear codes. In particular, we have shown that no pair of mutually orthogonal latin squares of even order generate a linear code.
Kinase activity and substrates for Drosophila projectin kinase

Alex Delcant and Agnes Ayme-Southgate, Biology

Projectin, a Drosophila myofibrillar protein, contains a kinase domain and is able to phosphorylate itself. This autophosphorylation occurs within two regions of projectin: the kinase domain itself and a central part called Core-1P, a 600 amino acid long domain. Projectin Kinase also phosphorylates in vitro vertebrate Myosin Light Chain2 (MLC2). My project consists of 1) the more precise identification of Core-1P phosphorylation site(s) and 2) the further testing of Drosophila MLC2 as a substrate. I first established a nonradioactive protocol for the detection of phosphorylation, using an antibody directed against phosphoSer/phosphoThr amino acids. I then generated two new clones containing a fraction of the original Core-1P region. These new clones were used to prepare fusion peptides representing portions of Core-1P. We also generated a bacterial fusion protein representing Drosophila MLC2 and tested it in an in vitro kinase assay.

Possible Correlation between the Internal Luminosity Function of a Gamma Ray Burst and the Burst Morphology

Matthew T. Thompson, Jon Hakkila, Department of Physics and Astronomy

Classification is a first step in the scientific process; it can lead to identification of specific behaviors representing physical mechanisms. Classification of gamma-ray burst (GRB) time histories (light curves) and spectra might improve our understanding of GRB behaviors. Furthermore, morphological classes might correlate with other burst properties. We examine the possibility that GRB morphological classes correlate with the Internal Luminosity Function (or ILF) of a GRB; this function represents the differential of luminosity within in a gamma-ray burst. Preliminary evidence indicates that a correlation between burst morphology and the ILF might exist.

The Internal Luminosity Function of Gamma-Ray Bursts

Andy Stallworth, Jon Hakkila, and Tim Giblin, Physics & Astronomy

Gamma-ray bursts (GRBs) are the most energetic phenomena in the universe. Although the observed properties of GRBs have provided valuable insights into the physics driving them, much about them is still shrouded in mystery. One GRB property that appears to be potentially useful in exposing underlying burst physics is the Internal Luminosity Function. The Internal Luminosity Function (ILF) is defined as the differential distribution of luminosity measured within a gamma-ray burst (Horack & Hakkila, Astrophysical Journal 479, 371, 1997). The ILFs of most GRBs can be modeled as a pseudo power-law luminosity distribution. The procedures used to measure this distribution from BATSE (the Burst And Transient Source Experiment on NASA's Compton Gamma Ray Observatory) data are discussed.
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**Mapping Kinetic Energy Flow Through an Organic Crystal**

Chris Garrick, Physics, and Kristin Krantzman, Chemistry and biochemistry

Secondary Ion Mass Spectrometry (SIMS) is an analytical technique used to identify organic molecules that are in a solid state. This technique involves hitting an organic solid with an ionic projectile in order to eject molecules from the solid and into the gas phase. I am studying the transfer of kinetic energy through an organic crystal of benzene during SIMS. The model that I am studying was produced by a research team led by Dr. Barbara Garrison at Penn. State. This model uses classical mechanics to find the position, velocity, and energy of each atom in the crystal at 10 fs time intervals. I am using Mathematica and Microsoft Excel to plot the energy of each atom of the crystal with respect to its initial position in the crystal. Using this technique, it becomes easier to see how kinetic energy propagates through the crystal. This research is important to help understand the types of collisions that take place during SIMS and to find a suitable and predictable technique for producing these molecules in a stable form.

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**Correlations between the Internal Luminosity Function and Properties of the Long Class of Gamma-Ray Bursts**

Stephen Fuller, Jon Hakkila, and Tim Giblin, Physics & Astronomy

The Internal Luminosity Function (ILF) represents the distribution of luminosity within a Gamma-Ray Burst (GRB). We search for correlations between ILF power-law indices and a number of other observed gamma-ray burst attributes for a large BATSE dataset. Two classes of GRBs are already recognized: long bursts (> 2 sec.) with soft spectra (fewer high energy photons) and short bursts (< 2 sec.) with harder spectra (more high energy photons). Our study focuses on the long soft GRB class. A strong anti-correlation is found between the ILF power-law index and burst duration, and a strong correlation is found between the ILF power-law index and duty cycle.

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**Correlations between the Internal Luminosity Function and Properties of the Short Class of Gamma-Ray Bursts**

Amanda Sprague, Jon Hakkila, and Tim Giblin, Physics & Astronomy

The Internal Luminosity Function (ILF) represents the distribution of luminosity within a Gamma-Ray Burst (GRB). GRB ILFs can be modeled to first-order as power-law distributions. Two classes of GRBs are believed to exist on the basis of duration and spectral hardness. The class of short GRBs (duration < 2 sec.) has not been studied in detail in the literature compared to the long duration bursts. We therefore examine the ILF behaviors of the short class and contrast them with the ILFs of long GRBs. We also search for
correlations between the ILF power-law indices and a number of other observed GRB attributes in the BATSE database.

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Effects of the Fluence-Duration Bias on FREDs (Fast Rise Exponential Decay Gamma-Ray Bursts)

Kevin Young, Jon Hakkila, and Tim Giblin, Physics & Astronomy

FREDs are gamma-ray bursts with the simple temporal structures; they ideally contain one broad pulse for which the decay time is longer than the rise time. Because of their slowly-decaying tails, FREDs appear to be particularly susceptible to the Fluence-Duration Bias (Hakkila et al., Astrophysical Journal 538, 165, 2000), which is a process by which faint bursts have their fluences (time-integrated flux) and durations systematically underestimated. We use Monte Carlo simulations to study the impact of the fluence-duration bias on FREDs.

21

A test of a differential fitness model for temperature-dependent sex determination in loggerhead sea turtles

Krystal Moseley, Biology Department

The evolutionary basis of temperature-dependent sex determination (TSD) is not well understood. Some hypotheses suggest that at different temperatures the production of one sex might have an advantage over the other sex. This study, conducted on South Island, South Carolina, compared incubation duration with hatchling size to determine if there is a correlation. We found that increased days of incubation correlated significantly (p>.0001) with greater hatchling weights, widths, and lengths. We suggest that females nesting on beaches in South Carolina may have an advantage (differential fitness) in producing male biased clutches with larger individuals because these individuals would have better chances of survival and be more likely to pass on their genes via migration to the much larger southern loggerhead populations of Florida.

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The Structure-Function Relationship of Chlorophyll in Photosynthetic Organisms

Jean Rockford, Amy Heaton, Mwende Kiambo, and Michelle Mac, Department of Chemistry and Biochemistry

Chlorophyll molecules in oxygenic photosynthetic organisms play a variety of roles, from harvesting photons of light to providing the initial reactions that produce molecular oxygen and essential biomolecules for the growth of the plant. The geometric structure of the molecule is unchanged in each of these roles, yet the chemical properties differ dramatically. Modulation of these properties is, most likely, the result of perturbations at the molecular level. These changes have been probed in paramagnetic chlorophyll
molecules by using electron magnetic resonance spectroscopy. Pulsed EMR spectra of chlorophyll cation radicals have been collected and analyzed to understand the electronic structure in vitro. By comparing the results from these studies to in vivo data, a better understanding of the structure-function relationships of chlorophyll in photosynthesis can be realized.

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Including Communication Skills in the Physical Chemistry Laboratory

Michelle Mac, Department of Chemistry and Biochemistry

Communication skills in students studying the physical sciences are often overlooked in the classroom, yet the ability of a young scientist to communicate clearly to colleagues and to the layperson is essential to ensure post baccalaureate success. Students are often able to communicate well within their peer group, yet lack the skills to discuss their work in an open forum. This poster outlines the approach taken in this semester's CHEM442 laboratory course to provide the students with the opportunity to write, communicate, and present scientific data to a diverse demographic.

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Effects of Hypercapnic Hypoxia on the Bactericidal Activity of Hemocytes from the Penaeid Shrimp *Litopenaeus vannamei*

Austin Dantzler, Karen Burnett and Lou Burnett, Grice Marine Laboratory and Department of Biology

The high densities of shrimp found in aquaculture ponds often cause dissolved oxygen levels to fall below 30% air saturation. Low oxygen is usually accompanied by increased carbon dioxide and low pH. Our lab has demonstrated that these conditions of hypercapnic hypoxia decreased the resistance of the shrimp *Litopenaeus vannamei* to infection with the bacterial pathogen *Vibrio parahaemolyticus*. The current study focused on the bactericidal activity of shrimp hemocytes under hypercapnic hypoxia. Hemocyte preparations exhibited two patterns of killing. One pattern was characterized by high viability of hemocytes over a range of calcium and magnesium concentrations (0-10 and 0-53 mM respectively), hemocyte lysates that enhanced bacterial growth, and killing activity that was suppressed by hypercapnic hypoxia. The second pattern was characterized by decreased viability with the addition of calcium and magnesium, hemocyte lysates that suppressed bacterial growth, and killing activity that was not affected by hypercapnic hypoxia.

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Is There a Class IV, Manganese-Dependent Ribonucleotide Reductase?

Rebecca Dagley, Chemistry & Biochemistry

All organisms can synthesize ribonucleotides, but in order to replicate and repair DNA, ribonucleotides must be reduced to deoxyribonucleotides. The enzyme responsible for this reaction is ribonucleotide reductase (RNR). Despite the universal requirement for this enzyme, the enzyme's cofactor has not been
evolutionarily conserved; RNRs are classified based on the required cofactor. Class IV RNR, typical of C. ammoniagenes, has been shown to have a unique manganese cofactor. However, some evidence has been presented to argue that the class IV RNR has a different cofactor. If we can show that the cofactor is manganese, this will be the first demonstration of a reaction involving the activation of oxygen by a manganese-bound enzyme. Knowing and understanding the mechanisms involved in this reaction could prove useful in the design and synthesis of antiviral and anticancer agents that target DNA synthesis.

Satellite Remote Sensing of Coral Reef Change

Qamar Schuyler, MES Program

I carried out satellite groundtruthing field work on Karang Kapota atoll, in the Wakatobi archipelago in Sulawesi, Indonesia. Using a SPOT (Systeme Pour L'Observation de la Terre) satellite image, I first georeferenced the image to the latitude/longitude coordinate system, then mapped ecological communities using a precision GPS unit. I created a preliminary classified image with six major habitats: seagrass, mixed seagrass, sand and rubble, coral, rock, and deeper coral/sand. I also ran depth transects to create a bathymetric chart of the atoll to aid in correcting the satellite signal for water column depth. Contrary to our original expectations, we found that seagrass was the dominant community, followed by sand and rubble, and then coral. I am now working on a more detailed classification scheme, and intend to analyze a series of several satellite photographs of the same reef over time to determine if ecological change can be measured from space.

Yucca Mountain as a Geologic Repository

Lauren M. Fuqua and Timothy J. Callahan, Department of Geology and Environmental Geosciences

High level radioactive waste from nuclear power plants is currently stored in 33 states. As materials increase, their future storage has become a concern. After assessing many storage options, the Department of Energy decided to focus on a geologic repository at Yucca Mountain, NV. Engineers have designed barriers that would work together with natural barriers to house the waste. Many geologic factors have been carefully investigated and evaluated to rate the performance of this potential site, such as structure, nuclear criticality, and hydrology. The effects of events like volcanism and seismic activity on a repository have also been evaluated. Along with site geology and repository engineering, future monitoring at Yucca Mountain is a key environmental and safety factor. Scientists have thoroughly assessed Yucca Mountain as a potential repository, and the decision is now a political one with much opposition from the state of NV and its residents.

Design of new primers for *Plagiorhynchus cylindraceus*, a parasite of passerine birds
Eric Pante and Amelia Viricel, Biology

*Plagiorhynchus cylindraceus* is an acanthocephalan parasite of passerine birds that has the isopod *Armadillidium vulgare* for intermediate host. During the early infection stage infected isopods cannot be separated from non-infected isopods by macroscopic techniques. Our goal was to develop a DNA probe to detect isopods infected with *P. cylindraceus*. The mitochondrial gene cytochrome oxidase I (COI) was chosen for analysis because it is a highly conserved gene in the animal kingdom. DNA from *P. cylindraceus* and *A. vulgare* was extracted and a 708 bp fragment of COI was amplified by PCR. The amplified DNA was then sequenced. Our *P. cylindraceus* COI sequences are the first known mitochondrial sequences from an acanthocephalan. We are comparing the COI sequences of different species of acanthocephalans and isopods in order to design new PCR primers that will reveal the presence of DNA of both species in a single reaction, i.e., extractions from infected isopods.

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**The Application of the MODIS/ASTER Airborne Simulator to the Study of a Rhyolite-Dacite Lava Flow at Glass Mountain, Northern California**

Miles, S.T., and Nusbaum, R.L., Department of Geology and Environmental Geosciences

Glass Mountain is a lava flow located in the Medicine Lake volcano east of the main axis of the Cascade Range. The lava produced at Glass Mountain is heterogeneous, including earlier dacite flows and a later rhyolite dome. With an age of approximately 900 years, Glass Mountain is still primarily unvegetated, making remote analysis of chemical composition possible.

We used MODIS/ASTER (MASTER) airborne simulator data for chemical variations and on-site investigations for textural variations on Glass Mountain. We found vesicularity variations at Glass Mountain on a scale less than the instrument resolution of 10 m. The distribution of these variations was not consistent on a regional scale. The application of a minimum noise fraction transformation resulted in the identification of dacite and rhyolite areas of the flow. These chemical variations correlated well with previously published data. Ongoing investigations use MODTRAN 4.0 to account for atmospheric correction.

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**Standardization Of Agent Platforms**

Donovan Lusk, Jason Ferreira, Frank Boneske, and Brian Drake, Department Computer Science

Autonomous Agents and Multi-Agent Systems are a rapidly growing field of research. Development of these systems requires uniform access to heterogeneous platforms and services. This paper introduces the Foundation for Intelligent Physical Agents (FIPA), which is the main organizational body responsible for developing agent standards. The benefits and drawbacks of implementing FIPA specifications is discussed, along with a brief comparison of two separate agent development toolkits that implement the FIPA standards. The two toolkits are: FIPA-OS and JADE.
The Common Testing Cycle and Complexity Analysis of Software

Eliska Scudder, Kristy Sattler, Chris Gould, Frank Rivers, and Al Silver, Computer Science

Software testing is an integral part of the software development life cycle. Testing is an ongoing process, not just a step to be performed at the end of the design stage. Testing allows faults to be detected earlier in the software design process, which provides financial and timesavings. There are many different types of faults and, accordingly, there are many different specialized forms of testing. The ability to predict the occurrence and type of errors is critical to the design of error-free software. Errors can be detected by both static and dynamic means in different stages of a program's design.

Software complexity measurement is a formal method that directly measures software attributes. Complexity metrics break large software systems down to their atomic parts so each part can be understood and manipulated in a systematic, mathematical way. This allows programmers to find efficient ways to write programs and test software, module by module. Complexity metrics are used in order to predict programming effort, intelligence content, and the type and location of faults. Complexity analysis is a useful tool that is beneficial to both the planning and execution of software testing.

Better Software Development Using Agile Methods

Hugh Campbell, Tom Dion, Tim Caulder, and Tom Bowen, Computer Science

Using Agile Methods help to provide a more efficient and adaptable process to software development. It gives the customer the ability to make modifications to the design of the project further along in the development process. The end result is a more satisfied customer and fewer headaches for the developers. The best part about Agile Methods, from the developers point of view, is that it provides benefits even when followed at a low level of discipline and allows the team to modify the process during development.

Survival and Proliferation of Microbial Pathogen Pseudomonas Aeruginosa in Water Filter Carafes

Sara Myers and Susan Morrison, Biology

In response to the rising use of water filter carafes for everyday drinking water, several experiments were performed to test for microbial survival and growth inside the filter. Diluted peptone solution containing Pseudomonas aeruginosa was first poured through the filter, followed by subsequent filtrations of sterilized peptone solution at 0 hrs, 24 hrs, 48 hrs, and one week following introduction of P.aeruginosa. Optical density tests and serial dilution plate counts showed that bacteria initially proliferate in the filter but then disappear between 48 hours and one week. A second trial affirmed these results. In a third trial in which peptone solution was filtered in repetitive 24-hour increments, there was a steady increase in bacterial
contamination in the filtrate after each filtration. This evidence indicates that if given the proper resources, Pseudomonas aeruginosa does thrive and multiply inside a water-filtering device.

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The Physics of the Cub Scout Pinewood Derby

Sean Dunn, Jennifer Hayes, Richard Woofter, and Laney Mills, Physics & Astronomy

The Pinewood Derby is a Cub Scout event in which small wooden cars are raced down a track. The Cub Scouts design their cars from kits containing only a block of wood and some wheels. The track is typically about 1 m high at the start with a 4 m slope followed by about a 1 m curving portion to a 4 m flat run to the finish line. Despite the fact that the speed of a point mass sliding down a hill is independent of the mass, it is known by all Cubs that the more massive cars go faster. This talk will explain why the mass matters and will present the results of precision measurements made on three cars: one of regulation mass, one half regulation, and one twice regulation mass.

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Feeding Ecology of Surf Zone Fishes

Kally McCormick, Marine Biology

The feeding ecology of selected fishes in a southeastern surf zone was examined. Samples were periodically collected in the shallow surf and analyzed with regards to stomach contents. Three fish species, the Florida pompano (Trachinotus carolinus), Gulf kingfish (Menticirrhus littoralis), and the Horse-eye jack (Caranx latus) were selected for primary study based upon relative abundance. Dissection of the gut revealed benthic fauna as the main prey items. A major prey item for each species was noted for the particular time period in which it was collected. Consumption of several organisms, such as amphipods, malacostracans, Emerita and polychaetes was noted for all fish species. Understanding the web of resource partitioning among the organisms of the surf zone will provide valuable information regarding trophic relationships. Understanding these relationships will provide a greater knowledge base so that future impacts can be lessened to allow for sustainability of this ecosystem.

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The Preparation of Fused-Ring Dihydroisoxazoles from the Condensation and Cyclization of Dilithiated 2-Tetralone Oxime with Aromatic Esters and Related Electrophilic Reagents

Emily Choi, James J. Sahn, Sally P. Grant, Maria D. Malatanos, J. Matthew Rhett, Morgan E. Warner*, Amanda D'Elia*, and Charles F. Beam, Chemistry & Biochemistry, *and Hanahan High School

The fused-ring heterocyclic compounds, 4,5-dihyronaph-[2,1-c]isoxazoles are among the less investigated compounds, possibly due lack of synthetic methodology. These compounds have resulted from
the condensation-cyclization of dilithiated 2-tetralone oxime with numerous electrophilic reagents, primarily aromatic esters. In each instance these products were made in a three step, one-pot reaction, involving lithiation, condensation and cyclization of intermediates that were not usually isolated. Since each compound prepared was new, they were characterized by absorption spectra with support from combustion analysis.

The synthesis requires available starting materials, a straightforward strong-base synthesis procedure, and multi-gram quantities of products are obtainable by recrystallization from common solvents. The compounds have potential for biological testing, other syntheses, and additional spectral studies.

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Preparation of Dihydroisoxazoles from Dilithiated Oximes and Acetophenones

Matthew J. Walters, Emily Choi, Morgan E. Warner*, Amanda N. D'Elia*, and Charles F. Beam, Chemistry & Biochemistry, *and Hanahan High School

The oximes of C(a)-ketones, such as 2-acetonaphthone and 4-chloroacetophenone, were dilithiated with disopropylamide. The resulting dianion type intermediates were condensed with a variety of acetophenones, such as 4-methoxyacetophenone or 3,4-dimethoxyacetophenone, which was followed by the addition of aqueous hydrochloric acid. Upon heating and stirring the two-phase mixture under reflux, cyclization occurred, and after standard work the targeted products were obtained. New dihydroisoxazoles were characterized by infrared spectra, C-13 [carbon] nuclear magnetic resonance spectra, and H-1 [proton] nuclear magnetic resonance spectra, with support from combustion analyses.

In general, dihydroisoxazoles are well known for use in other syntheses, additional spectral studies, and biological testing in both agriculture and medicine. Dihydroisoxazoles of this substitution type [methyl and substituted phenyl group at the 5 position] prior to this study have been difficult to prepare by other methods.

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Preparation of 5-Isxazolecarboxamide from the Condensation and Cyclization of Dilithiated Oximes with Lithiated Oxanilate

J. Matthew Rhett, Jennifer R. Downs, Emily Choi, Maria D. Malatanos, James J. Sahn, and Charles F. Beam, Chemistry & Biochemistry

Several dilithiated C(a), O-oximes were prepared in excess lithium diisopropylamide and condensed with lithiated ethyl oxanilates to give C-acylated intermediates that could be isolated or occasionally cyclized directly with aqueous acid to afford substituted 5-isoxazolecarboxamides. In all instances, the condensation of the dilithiated oximes with these electrophiles resulted in C-acylated intermediates that had to be isolated and cyclized to the desired 5-isoxazolecarboxamide.

Essentially every compound targeted and prepared is new because of the difficulty inherent in other methods, and the syntheses represent another group of reactions where an anionic nucleophile is condensed with an anionic electrophile. Also, related azole carboxamides have been prepared and studied for their potential for biological activity, especially in agriculture.
Preparation of Dihydrobenzylindazolobenzoxazinones from Dilithiated Carboalkoxyhydrazones of 1- and 2-Tetralone and Lithiated Salicylate Esters

Sally P. Grant and Charles F. Beam, Chemistry & Biochemistry

Several carboalkoxyhydrazones of 1- and 2-tetralone were dilithiated with excess lithium diisopropylamide, condensed with select esters followed by acid cyclization to new dihydrobenzindazoles. The synthetic procedure has been expanded to also include condensation-cyclization of dilithiated 1-tetralone carboxmethoxyhydrazones with lithiated methyl salicylates to afford dihydro-benzindazolo-benzoxazines. The condensation of this dianion-type intermediate followed by cyclization gave the fused-ring benzothiopyranone. In addition to new three or five fused-ring systems, the products resulted from a regioselective process, and they usually have the practical advantage of being purified in multi-gram quantities by recrystallization from common solvents.

Some of these compounds contain a pyrazole structural unit, and others contain a coumarin-pyrazole structural unit. Many of these compounds have agricultural biological potential, and other have potential for the preparation of charged tris(pyrazolyl)borate ligand (Tp) and related ligands.

Preparation of Styryl Isoxazoles from Dilithiated Oximes, Methyl Cinnamate or Other Esters

James J. Sahn, J. Matthew Rhett, Sally P. Grant, Emily Choi, Maria D. Malatanos, and Charles F. Beam, Chemistry & Biochemistry

Another project dealing with the unequivocal preparations of unsymmetrical isoxazoles using strong-base multiple anion synthesis techniques has involved the condensation-cyclization of dilithiated benzalacetone oxime with a variety of aromatic esters, and the condensation-cyclization of other dilithiated oximes with methyl cinnamate. The C-acylated intermediates were not isolated, and they could be immediately cyclized with aqueous acid to afford the desired products.

Each new isoxazole was characterized by absorption spectra with support from combustion analysis. Isoxazoles are also known for their biological potential, use in other syntheses, and spectral studies.

Preparation of New N-Carbobenzyloxypyrazoles

Maria D. Malatanos, James J. Sahn, J. Matthew Rhett, Sally P. Grant, Emily Choi, and Charles F. Beam, Chemistry & Biochemistry
During our investigations for a convenient three-step one pot synthesis of N-H pyrazoles, we explored the possibility of dilithiation of several C(a),N-carbenzyloxyhydrazones with select esters, followed by acid hydrolysis to the pyrazole N-carboxylic acid, which would decarboxylate to the N-H pyrazole. This process did not occur and C-acylated intermediate compounds or the N-carbenzyloxypyrazoles were isolated instead, and the extent of the synthesis of new pyrazoles was also explored.

Every compound prepared was new, which included carbenzyloxy-hydrzones, C-acylated products, and new pyrazoles. All new compounds were characterized in a standard manner, with absorption spectra with support from combustion analysis.

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**Variable Temperature FT-IR of Krypton Solutions and ab initio Calculations of ClCH$_2$SiH$_2$X (X = F, Cl, Br)**

Gamil A Guirgis and James R. Durig*, Chemistry & Biochemistry, *Department of Chemistry, University of Missouri-Kansas City

Variable temperature (-105 to -150 C) studies of the infrared spectra of chloromethyl silyl chloride, ClCH$_2$SiH$_2$Cl, and chloromethyl silyl bromide, ClCH$_2$SiH$_2$Br dissolved in liquid krypton have been carried out. From these data, the enthalpy differences have been determined to be 205±41 cm$^{-1}$ (2.45±0.49 kJ/mol), and approximately 200 cm$^{-1}$ for the chloride and bromide, respectively, with the more stable form being the trans conformer for each molecule. The experimental enthalpies are consistent with the predictions from the ab initio calculations at both the Hartree-Fock level and with full electron correlation by the perturbation method to second order MP2. It is estimated that 57% of ClCH$_2$SiH$_2$Br are in the trans form at ambient temperature. The structural parameters, conformational stabilities, harmonic force fields, infrared intensities, Raman activities, depolarization ratios, and vibrational frequencies, have been obtained for both conformers for all three halides from MP2/6-31G(d) ab initio calculations utilizing several different basis sets with full electron correlation by the perturbation method up MP2/6-311+G(2d,2p) and by density functional theory (DFT) calculations by the B3LYP method. Similar studies are in progress for ClCH$_2$SiH$_2$F which is expected to have large percentage of the gauche conformer present at ambient temperature based on the ab initio calculations compared to the amount of this conformer for the other.

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**Conformational Equilibrium in Allyl trichlororosilane Studied by Infrared and Raman Spectroscopy and by ab initio calculations**

Gamil A. Guirgis, Rick Heldrich, Valdemaras Aleksa* **, Peter Klaeboe* and Claus J. Nielsen*, Chemistry & Biochemistry, *Department of Chemistry, University of Oslo, Department of General Physics and Spectroscopy, Vilnius University

The infrared spectra of allyl trichlororosilane (CH$_2$=CHCH$_2$CH$_2$SiCl$_3$) have been recorded as a vapor and as amorphous and crystalline solids in the 4000-50 cm$^{-1}$ range and isolated in argon and nitrogen matrices at ca. 5 K. Raman spectra were recorded at room temperature and at various temperatures between 295 and
153 K. Spectra of the amorphous and crystalline solids were obtained at 80 K and at 180 K. The compound probably exists in two conformers, syn and gauche, however, the equilibrium is highly shifted towards gauche to the extent that ca. two percent of the anti is present at room temperature and much less in the amorphous phase at 78 K. No Raman or infrared bands from the amorphous phase at 78 K seem to vanish after crystallization. In the nitrogen matrices the weak bands at 1641, 1422 and 997 cm\(^{-1}\) vanish after the matrices were annealed to 32 K and similar results were observed in the argon matrices after annealing to 36 K. The vanishing bands probably belong to the syn conformer.

Ab initio calculations were carried out with the Gaussian 98 program using the basis sets: RHF/6-31G*, B3LYP/6-31G*, B3LYP/6-311G*, B3LYP/6-311+G*, B3LYP/6-311+G** and B3LYP/6-311++G*. The following enthalpy differences: \(\Delta H\) (syn-gauche) were obtained: 13.0, 12.9, 12.6, 12.2, 12.0 and 12.1 kJ mol\(^{-1}\), respectively. Infrared and Raman intensities and the vibrational frequencies for the syn and gauche conformers were calculated. After appropriate scaling a reasonably good agreement was obtained between the experimental and calculated wavenumbers for the gauche conformer.

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**Microtubules and microfilaments both direct motility within elongating conifer pollen tubes**

Chip Justus and Mark Lazzaro, Biology

The angiosperm model for cytoplasmic streaming maintains that motility in the tip of elongating pollen tubes follows a reverse fountain pattern. However, we find that in the conifer Picea abies (Norway spruce) organelles move in a distinct fountain pattern at the tip of elongating pollen tubes. These pollen tubes have a unique localization of microtubules at the tip, so we hypothesized that the motility of organelles and vesicles in a fountain pattern was directed along the microtubule cytoskeleton. Amiprophosmethyl disrupts microtubules and was injected into growth media 600 um away from the growing pollen tube. After injection of APM, pollen tube elongation stopped and the fountain streaming pattern ceased. Due to the disruption of microtubules, the tube began to undergo a breakdown of organization at the tip. Latrunculin B disrupts microfilaments and was injected into growth media surrounding pollen tubes in separate experiments. Microfilament disruption also inhibited tube elongation and cytoplasmic streaming. However, uncharacteristic to the APM treatments, long membrane tubules began to accumulate in the tip. We conclude that movement along both microtubules and microfilaments controls the unusual streaming pattern, and that microtubules maintain cellular organization at the tip.

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**A Design for a Prefabricated Martian Greenhouse**

Warren May and Terry Richardson, Physics & Astronomy

A prefabricated greenhouse structure was designed to be sent to Mars as part of a manned Martian expedition. This design was done in conjunction with the NASA MarsPort Student Engineering Design Competition. The design and the NASA competition will be detailed. The greenhouse design included a shell constructed from a nanocomposite material with ballistic resistant properties and films coating on the shell to allow for maximum passage of wavelengths most beneficial to plant growth. Automated systems
inside the greenhouse aid in growth, maintenance, and harvesting of crops. Deployment of the greenhouse is designed for the same time as a landing by a team of astronauts or prior to their landing.

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Prevalence and intensity across time and salinity in two species of copepod and one branchiuran parasitic on the gills of the striped mullet (Mugil cephalus)

John Parke Davis and Isaure de Buron, Biology

Two genera of copepod and one branchiuran parasitic on the gills of Mugil cephalus, the striped mullet, were investigated for prevalence and mean intensity over a three month period in the upper and lower parts of the Ashley and Cooper Rivers. Ergasilus spp., Argulus spp., and Bomolochus nitidus were all found in varying numbers across environments. Ergasilus was found to have an extremely high prevalence across both time and salinity, varying only in increase of overall prevalence over time. However, mullet from brackish water had a significantly higher mean intensity than those caught in fresh water, varying little over time. Conversely, Argulus spp. and Bomolochus nitidus were found to have an extremely low prevalence and mean intensity across time. It is speculated that this may be an artifact in data collection due to the weak attachment devices of these two genera.

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The concurrent validity of qualitative scores for the Controlled Oral Word Association Test

Valerie Baker and Thomas P. Ross, Psychology

This study examined qualitative performance indices that reflect strategy usage on neuropsychological tests of memory and executive functioning. Seventy-three healthy, undergraduate students from the College of Charleston were administered the Controlled Oral Word Association Test, the California Verbal Learning Test, and the Ruff Figural Fluency Test. Both traditional and qualitative scores reflecting strategy usage were analyzed using Pearson Product Moment Correlations. Cluster scores on the COWAT, a verbal fluency measure, were correlated with cluster scores on the RFFT, a test of nonverbal fluency. Neither COWAT nor RFFT strategic cluster scores correlated with semantic cluster scores on the CVLT, a memory measure believed to involve executive control processes. Results support the concurrent validity of scoring systems that reflect strategy use among executive measures (e.g., COWAT and RFFT), but this type of strategy utilization does not appear to extend to measures of verbal memory.

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4CVn: Amplitude Variability

Kwayera Davis and Robert J. Dukes Jr., Physics & Astronomy

4 CVn is one of the most extensively studied Delta Scuti stars. We observed it with Four College
Consortium Automatic Photometric Telescope (APT) (1990-91). Due to a problem with the comparison star the data were not analyzed. In 1996 4 CVn was the subject of a Whole Earth Telescope (WET) campaign (Breger, et. al 1999) which found 30+ frequencies. Breger (2000) collected all observations over the last 30 years and studied the amplitude variation found in the 1996 campaign. A serious gap occurs in this data from 1984-1996. Since our data is in the middle of this gap we have reduced it with respect to the check star. We applied similar techniques using Period98 (Sperl 1998) to find the frequencies of the WET analysis. We fit many of these frequencies and calculated their amplitudes. The amplitudes presented here may further the understanding of the amplitude variability 4CVn.

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AFLP Survey of CO1 Variation in a Freshwater Snail

Zachary Evans, Jessica Pease, Robert Frankis, and Robert Dillon, Biology

Previous studies have revealed two strikingly different haplotypes of the CO1 mitochondrial gene in a population of the freshwater snail Goniobasis proxima collected from southern Virginia. A small sample of three individuals showed two haplotypes differing at 14.7% of 709 nucleotide pairs. This variation could be caused either by an introduction of colonists from an external population or by evolution within the population. We have completed restriction enzyme analysis using Sac1 and Dde1 on 15 individuals from this population in search of intermediate sequences between the haplotypes C1 and C2. We observed 5 individuals matching haplotype C1, no individuals matching the predicted digest pattern for the haplotype C2, and 10 individuals with 2 digest patterns unpredicted from the two previously known sequences. We sequenced one of the C1-like individuals and found it 4% different from C1 and 18% different from C2. Thus we may infer that the high level of mitochondrial deviation within this population may be the product of endogenous evolution.

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On the Importance of Metadata in Forested Wetlands Research

Jim Weeg, Antoinette Reale, and Timothy Callahan, Geology

We compiled metadata for the Santee site in the Francis Marion National Forest in support of the United States Forestry Service (USFS) HydroDB project. The HydroDB project has been developed to provide the public easy access to hydrological and meteorological information for National Forests around the U.S. This information is organized in a way that allows the user to compare different sites based on certain descriptors; that is, the metadata. For example, the metadata include the physical location and characteristics of the Santee site. We also include the types of equipment we use to collect hydrological and meteorological information and the equipment capability in the metadata.

Another objective was to compile such data as watershed boundaries, flow rates, and elevation points to produce a two dimensional depiction of the Santee watersheds using ArcView GIS. This software also enables the user to create subwatershed so that flow at the larger scale can be more accurately calculated. This database will enable the user to experiment with different perimeters of the watershed to find the most accurate model for the site. Also, the database can be updated with new information taken from the site. This database will help scientists measure water quality, predict flood events, and evaluate watersheds.
The Gene mtMSH and its Importance in the Identification of Gold Corals (Primnoidae)

Megan C. Barkes and Scott C. France, Biology

Currently species of octocorals are classified by the morphology of their sclerites. To date, there have not been many studies using DNA to distinguish between octocoral species. Recent studies have shown the mitochondrial gene MSH to be variable in octocorals. In this project I extracted and PCR-amplified DNA from two species in the family Primnoidae. I sequenced the MSH gene entirely for Calyptrophora sp. (2961 bp; 987 amino acids) and partially for Narella (2255 bp). The MSH sequences for Calyptrophora and Narella had a percent difference of 2.7% over the 5' 750 bp, and compared to other octocoral species they differed by 11.6-16.1%. A phylogenetic analysis of the MSH data showed the primnoids were most closely related to the precious pink coral Corallium, which agrees with previously published phylogenies based on other data.

Problems in Wetlands Delineation from the Viewpoints Of Major Stakeholders in South Carolina

Terri Mashour, Biology and Political Science

Wetlands delineation is an essential principle in regards to protecting wetlands (e.g., Kusler and Opheim, 1996; Tiner, 1999). Wetlands delineation is the process of identifying wetland areas and boundaries in order to perform environmental assessments. Wetlands delineation in itself is a complex issue, however politics create additional dilemmas. The focus of this research project involves identifying policy problems in the wetland delineation process. This project identifies the stakeholders involved in the process and identifies the major policy challenges in wetlands delineation. Interviews with the major stakeholders, such as the US Army Corps of Engineers, involved in each aspect of the wetlands delineation process in South Carolina were conducted for the project. These interviews were analyzed through content analysis and themes were identified. From this study, results identify several issues that must be addressed and reformed in order to develop a more effective wetlands protection process in South Carolina.

The Noisette Creek Redevelopment Project: Wetlands Buffer Policy in North Charleston, SC

Rick Vaughn, Political Science
In an intensive urban area, land use decisions can have severe affects on wetland functionality through point and non-point source discharges (OCRM, 1995). The Noisette Creek Redevelopment Project (NCRP) in North Charleston, South Carolina is a one billion-dollar redevelopment project that could have substantial impact on the wetland areas within its project area. Other communities have used buffers to address potential negative impacts from development. Buffers are zones or strips of land between sensitive areas such as wetlands and developed areas; "buffers protect wetlands from erosion and pollution by filtering runoff" (OCRM, 1995). Currently, North Charleston does not have a wetlands buffer policy. This poster examines the following research question: What are the major constraints in developing a wetland buffer policy for an area currently experiencing redevelopment? The case of the NCRP in North Charleston, South Carolina is examined to pinpoint likely constraints to the implementation of wetlands buffer policy.

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The Semantic Web

Abbie Hairfield, JD Gist, Yvonne Harryman, Bob Hebbard, and Kimberly Nowocin, Computer Science

In this paper, we describe the Semantic Web. The Semantic Web is an extension of the World Wide Web (WWW) that gives meaning to the documents so that machines can read them, versus HTML that allows only humans to read. XML (Extensible Markup Language) and RDF (Resource Description Framework) are discussed in detail, allowing the rules and grammar to be set up to create a language that the semantic web can use. Ontologies establish relationships between the terms defined by the XML and RDF Schemas. Agents use this information in order to perform accurate and meaningful searches and provide a standardized way for machines to communicate. Presumably this will allow an ideal way for the exchange of data allowing correct information, quicker access to that information, and the trustworthiness of information. This will allow the evolution of knowledge, which the WWW cannot achieve today, due to the incorrect, irrelevant, and abundant information found on searches of the WWW presently.

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Development of a Micro-protein Assay for Use in Future Studies on Invertebrate Parasitic Infections

Erin Alesi, Isaure deBuron, and Vince Connors, Biology

The modification of a standard micro-protein assay suitable for quantifying the amount of protein in invertebrate hemolymph sample sizes as small as 1ul was necessary in order to accurately perform protein electrophoresis. Hemolymph used in the modified protein assay was obtained from both juvenile and adult Armadillidium vulgare. Plastic 1.5 ml centrifuge tubes instead of borosilicate glass 12 ml tubes were used to set up standards and perform dilutions. Consistent results were obtained by adding 100 ul of working reagent and either 100 ul of BSA protein standards or 100 ul of a 1250x hemolymph dilution sample directly into the wells of an ELISA plate. Once hemolymph protein was quantified, samples were diluted both 10 and 50 times, and content was analyzed using SDS-PAGE. The modified protein assay will be used in studies to analyze parasite-induced differences in invertebrate hemolymph protein content.
Expression of Peroxisome Proliferation-Activated Receptor in Cancer Cells

Raquel Pacheco and Carlo V, Catapano, Biology

PPAR (ligand-dependent transcription factor) activate genes is involved in various aspects of cell metabolism. PPAR is over expressed in cancer cells compared to normal cells. Because of the significant role of PPAR activity we evaluated PPAR expression and function in cancer cell lines and normal tissues. As a result PPAR is frequently up-regulated in tumors compared to normal tissues. These finding play a significant role suggesting that NSAID and other PPAR- targeted therapeutics might be useful in preventing and treating cancer.

Initial Synthetic Approach to the Antibiotic Cytosporones D and E

Jeffrey D. Hall, Joshua C. Kister, and Justin K. Wyatt, Chemistry and Biochemistry

There is an ongoing search to identify and synthesize new biologically active secondary metabolites. Cytosporones D and E were recently isolated from the antibacterial active culture broth of two edophytic fungi, CR200 and CR146. The two new cytotoxic trihydroxybenzene lactones show strong antibacterial activity against strains of Staphylococcus aureus, Enterococcus faecalis, Escherichia coli and Candida albicans. The trihydroxybenzene moiety of these novel octaketide antibiotics appears to be the source of the antibiosis activity, because when matched with structures that are similar but are only dihydroxybenzenes there is no antibacterial activity. A synthesis of these compounds is needed because it is not cost effective or time efficient to obtain large quantities of these compounds by harvesting active broth cultures. Therefore, development of a quick synthetic route involving the alkylation of a chiral oxazoline intermediate to set the only chiral center for each antibiotic is utilized.

The Forgotten Pollutant: Light

Robert J. Dukes, Jr. and Katherine E. Andrews, Physics & Astronomy

Today pollution is an important issue. We are quite concerned with energy efficiency of our houses and cars. We criticize industries for various forms of pollution. One pollutant we usually forget about is light. To an astronomer pollution is one of the most important environmental issues. It should be so to everyone for several reasons. First, the heritage of Western culture is based on ancient peoples observations of the night sky. Today we (and our children) are denied the beauty of this night sky so familiar to our ancestors. Also the energy resulting in light pollution is wasted energy. It is estimated that the United States spends about 4 billion dollars a year on wasted, outdoor light energy. In this presentation we will discuss the basics of light pollution such as glare, upward light, and light trespass. The presentation will be illustrated with examples of good and bad lighting in the Charleston area. This work has been funded partially by a grant from the South Carolina Sustainable Universities Initiative.
Light Pollution: Its Effect on Observational Astronomy at the College of Charleston

Katherine E. Andrews and Robert J. Dukes, Jr., Physics & Astronomy

Observational astronomy classes at the College of Charleston are becoming more and more hampered by light pollution, both from the campus and the surrounding metropolitan area. In this paper we report on a quantitative study of this pollution and identify some of the major offenders. For example, we will show the effect of the sports illumination at the Riley Baseball Stadium and the Mt. Pleasant Sports Complex. We will also identify some other especially obnoxious light sources close to campus. Our measurements are based on the "Simple Dark-Sky Meter" as described by Gote Flodqvist (2001, Sky and Telescope, 101, 138). This work has been supported by a grant from the South Carolina Sustainable Universities Initiative.

Wireless Handheld Applications for Classroom Instruction and Testing

Jonathan Yantis, Philip Kramp, Arpan Kotecha and Lancie Affonso, Computer Science

With the increasing availability and use of handheld computers, such as Windows Pocket PC devices, and wireless networks, it has now become possible to take advantage of in-class use of computers for immediate feedback from the students to the instructor and from the instructor to the students. The goal of this research study is to investigate how wireless handelds can assist undergraduate faculty in integrating various technologies including concept tests into classroom management and assessment procedures. Also included is a discussion on interfaces for handhelds to leverage the capabilities of WebCT, a web course development tool, used at the College of Charleston as a supplement for traditional lecture based courses.

Facial Musculature associated with the Preorbital Fossa of White-tailed Deer

Sarah Dawson and W. J. Hillenius, Biology

The facial musculature of four white-tailed deer, *Odocoileus virginianus*, was dissected and compared to the dissected musculature of three other mammals, the domestic cat (*Felis catus*), the domestic dog (*Canis familiaris*), and the pig (*Sus scrofa*). The deer and the pig both possess a shallow depression in the surface of the skull, anterior to the eye, called the pre-orbital fossa; this feature is absent in most other mammals. However, while the muscles associated with this depression in the pig closely resembled those of typical mammals, the facial muscles of the deer differed in some respects. In the pig, cat, and dog, the m. malaris consists of a single strap, which originates directly below the eye. In contrast, the deer had a bi-faceted m. malaris. One slip of m. malaris did originate below the eye; the other was anchored on the upper rim of the preorbital fossa and continued deep to the first slip. The m. zygomaticus was superficial to the m. malaris in the deer, cat, and pig. Conversely, in the dog the m. zygomaticus was deep to the m. malaris. In the deer, dog, and cat, the frontalis and the nasolabialis formed a continuous sheet in which muscle striations
gradually changed direction. In the pig, the frontalis muscle was confined to the region directly between the ears. The deer and dog had a frontalis muscle that was both deep and superficial to the upper region of the orbicularis oculi.

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Deletion of Homer2 does not alter learning and memory

Stephanie E. Shealy, Psychology

Mice homozygous for a deletion of the homer2 gene (homer2 KO) display elevated basal glutamate levels in the striatal complex, a region involved in motivation and spatial learning. Given that glutamate transmission is considered a critical mediator of various types of learning, homer2 KO and wild type (WT) mice were compared in a Morris water maze task and a water version of the radial arm task. To determine visual ability, homer2 KO and WT mice were compared in a visual platform swim escape test. No differences were observed between homer2 KO and WT mice in any of the experiments. In the visible platform task, both genotypes were capable of locating the platform within 2 training trials, indicating that vision is intact in homer2 KO mice. In the Morris water maze task, no genotypic difference in the latency to reach a hidden platform was observed across training trials nor were differences observed in the swim behaviour of mice in the platform area on two memory tests conducted at 24 hrs and 1 week following training. In the radial arm maze task, both genotypes were capable of locating hidden platforms and remembering to avoid the locations of these hidden platforms. These data indicate that, despite elevated basal glutamate levels, spatial learning and memory, as well working and reference memory are intact in homer2 KO mice. These data suggest that constitutive expression of Homer2 is not necessary for spatial learning and memory or working and reference memory under conditions of high motivation.

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Possible Influence of Tidal Height on Symbiont Occurrence in the Marine Sponge Hymeniacidon heliophila

Jennifer Ikerd, Biology

Symbionts of many taxa are commonly abundant in the many water channels of sponges. In the present study, specimens of the common marine sponge Hymeniacidon heliophila were collected from saline waters under the Oak Island Creek Bridge, James Island, South Carolina, to determine if the abundance and taxa representation of these symbionts differed with respect to the vertical tidal distribution of the sponge. H. heliophila was collected one day after the October 2001 full moon so as to ensure that intertidal and subtidal zones could be easily differentiated. Sponges were collected from subtidal, mid-intertidal, and high intertidal sites, immediately preserved in the field, and their animal symbionts identified and counted. Nematodes, copepods, amphipods, ostracods, and polychaetes were the major symbiont taxa present in sponges from each tidal zone. Unexpectedly, the data suggest that the symbiont faunal assemblage is largely the same in the three tidal zones, with minor differences evident in some taxa. Apparently, the mid-intertidal and high intertidal sponges are able to retain enough water to maintain their symbionts, even under spring low tide conditions.
**Naobranchia spp. (Naobranchiidae) a gill copepod of Mugil cephalus (Mugilidae)**

Samana Schwank, Biology

Mugil cephalus commonly called the striped mullet inhabit the fresh, estuarine, and marine waters of South Carolina. M. cephalus caught in the Ashley and Cooper rivers were used to examine the parasite load on their gills. Two different locations were chosen to collect fish, the upper rivers (freshwater), and the lower rivers (marine water). This study focused on the highly specialized copepod Naobranchia spp., which was found at a higher intensity and prevalence in the lower rivers compared to the higher rivers. It was found that Naobranchia spp. had no significant preference between the first, second, or third gill arch, but only 6.1% were found on the fourth gill arch. It was also found that Naobranchia spp. had a preference of attaching to the upper portion of the gill arch.

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**A Neuroanatomical Study of an Efferent Projection from the Ventral Tegmental Area (VTA) to the Mediodorsal Thalamic Nucleus (MD)**

Eric Angermeier, Department of Neuroscience, MUSC

Regulation of the mediodorsal thalamic nucleus (MD) by the ventral tegmental area (VTA) is a key element in understanding mental processes such as drug addiction (Robinson and Berridge, 1993; Di Chiara, 1995; Mirenowicz and Shultz, 1996), and disorders such as schizophrenia (Egan and Weinberger, 1997). It has previously been reported that there is an efferent projection of the VTA to the MD (Beckstead et al., 1979) and that this projection is at least partially dopaminergic (Groenewegen, 1988). In this study, we utilized fluorescent retrograde tracer dye staining as well as immunocytochemical labeling in order to test our hypothesis that this projection does exist and that it utilizes both dopamine and GABA as neurotransmitters. Our preliminary findings confirm the dopaminergic nature of the projection, but further investigation is needed in order to determine whether the projection utilizes GABA. Currently, we are developing a more sensitive method for labeling which utilizes in situ hybridization with radioactive probes. Future experimentation will also include a more quantitative analysis of the VTA-MD projection.

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**Unresponsive Invertases Put Seagrasses at Risk**

Meredith Caldwell and Tom Arnold, Biology

Plant invertase enzymes catalyze the processes by which sucrose is cleaved into two monosaccharides, glucose and fructose, providing an important source of carbon and energy for plants' defense mechanisms. Invertases in turtlegrass (Thalassia testudinum) were examined following simulated herbivory, to evaluate their role in the activation of chemical defense. Soluble invertase activity decreased significantly in response to wounding, while no change was observed in the activity of cell wall invertase. Invertase levels were expected to be higher in the wounded plants, but the opposite was found. This explains the discovered
tradeoff between growth and tannin production. Because seagrasses did not get additional resources via sucrose cleavage plants allocated existing resources to tannin production instead of plant growth.

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**A Late Cretaceous Dinosaur Locality from the Los Altares Region of Northeastern Mexico**

Claire E. Terhune, Departments of Sociology and Anthropology, Geology, and Biology

In 1999 an international paleontological team began excavations on a new dinosaur locality in the Los Altares region of Northeastern Mexico. Campanian in age (70-75 MYA), this site has yielded a rich concentration of dinosaur remains with at least three individuals partially articulated. Surface collection has resulted in elements of gar, bowfin, turtle, crocodile, conifer trunks and palm impressions, as well as a fossilized oyster reef bearing remains of oysters, gastropods, sharks and rays. These fossils are found in the Aguja formation, the lithology of which indicates a marginal marine or deltaic environment.

Dominating the dinosaur fauna are hadrosaur remains, but elements of carnivorous dinosaurs and an isolated ceratopsian long bone have also been identified. Recent excavations have focused on a disarticulated hadrosaur, analyses of which indicate that a preferential post-mortem orientation of the long bones took place prior to burial in anoxic muds. Preparation of the specimens recovered thus far is ongoing. Currently at the College of Charleston are two Kritosaurus sp. ulnae and one ceratopsian femur, likely representative of Chasmosaurus mariscalensis.

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**Jasmonic acid promotes youthful, anti-herbivore responses in tree leaves**

Eileen Stocum, Adam Kavalier, Carolina Velez, and Tom Arnold, Biology

Plants often respond to herbivore attack by inducing the production of toxic and/or deterrent chemical defenses. However, responsiveness wanes with age and, in general, only young plant tissues are "inducible". It was hypothesized that tree leaves subjected to continuous attack would slow their development so as to remain "inducible" for a longer period of time. To test this, the leaf development of hybrid poplar saplings was examined when plants were challenged with 1mM jasmonic acid (JA), a plant wound signal that mimics insect attack. JA-treated saplings displayed signs of retarded development, including reduced growth and higher sink strength, and exhibited a significant induced chemical defense for a longer period of time. The results support the hypothesis that leaf development is slowed during herbivore attack.

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**Vitamin D Levels in Lactating Mothers' Breast Milk as a Function of Skin Pigmentation**
Meghan Roberts, James Smiley, Carol L. Wagner*, and Bruce W. Hollis*, Biology and *MUSC

Vitamin D deficiency, considered a disease of the 19th and early 20th centuries, has remerged possibly due to changed lifestyles. There have been reports of rickets in breastfeeding infants, particularly those living at higher latitudes and with darker pigmented skin. Motivated by these findings, we sought to determine if the levels of vitamin D and its metabolites are low in breast milk; if there is a correlation between skin pigmentation and vitamin D levels; and if there is a correlation between seasons and vitamin D levels in mothers residing at the Charleston latitude. Thirty-five breast milk samples from 18 African American and 17 Caucasian mothers were analyzed for their vitamin D2, vitamin D3, 25(OH) D2, and 25(OH) D3 concentrations using HPLC and radioimmunoassay.

We consistently found breast milk vitamin D concentrations were lower than expected, especially in darker pigmented women. Mean 25(OH) D2 concentrations in breast milk (17.73 pg/ml) were found to be lower than required to keep infants from risk of rickets (>5 ng/ml). There were no statistically significant differences between degree of skin pigmentation and vitamin D levels. These results aid in establishing normative data for vitamin D human milk concentrations in darker pigmented women compared to lighter pigmented women and emphasize the need for more research into maternal versus infant supplementation with vitamin D.

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Hot spot or not: evidence for emplacement mechanisms of 200ma Carolina diabase dikes

Michael Alexander and Erin Beutel, Geology and Environmental Geosciences

Around 200 m.y.a., Pangea began breaking up and North America and Africa began to separate. A hot spot off Florida is given to be the cause of the split between North America and Africa. Radial swarms of vertical igneous intrusions, dikes, and large igneous provinces have been cited as the main evidence for a hot spot. Our preliminary investigations suggest that the dike pattern in the Carolinas is not systematically radial about a central point off Florida. Since dikes form perpendicular to extensional stress in the crust, varying dike orientations in the Carolinas suggest changing stress fields during separation of the continents. Dikes are also relatively easy to date and therefore can be used to delineate post-rifting stress events. By studying the 200 m.y.a. Carolina dikes, a model for continental rifting mechanisms can be assessed and therefore applied to other regions of the world.

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The Relation Between Test Anxiety, Attention, and Memory

Honors Introductory Psychology Students, Susan J. Simonian and Cindy May, Psychology

The present study investigated the relationship between test anxiety, attention, and memory. Twenty-four participants completed a standard test anxiety scale, as well as an attention task and a memory task. For the Stroop task, we recorded color naming time on three cards with different stimuli: (a) color patches, (b) color words (e.g., "RED") printed in colored ink, and (c) anxiety-related words (e.g., "EXAM") printed in colored ink. For the memory task, we assessed hits and false alarms in a paradigm designed to
evoke both neutral (e.g., "sweet") and anxiety-related (e.g., "test") false memories. Results indicated that test anxiety impacted some, but not all, cognitive measures. Relative to low-anxious individuals, high-anxious participants responded more slowly on our attentional task, and were more susceptible to anxiety-related false memories. However, the two groups showed similar susceptibility to distraction, and showed equivalent hit rates and false memories for neutral items in our memory task.

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A preliminary study of metamicrocotylid monogeneans, parasites of the striped mullet, Mugil cephalus (Mugilidae)

Tiffany Baker, Biology

Metamicrocotylid monogeneans are gill parasites of fishes that have specialized clamps on their opisthaptors (attachment devices) in order to effectively hold on to the gill filaments of their hosts. In this study, two species, Metamicrocotyla cephalus and Microcotyle mugilis, were identified according to specific morphological features that will be presented. These monogeneans were acquired via necropsy of specimens of Mugil cephalus, the striped mullet, which is an abundant euryhaline fish found in the Charleston estuarial area. Statistical analysis of the prevalence and intensity of these monogeneans showed an aggregated distribution and a preference for higher salinities. Most of the metamicrocotylids were found on the first and second gill arches of their mullet hosts. In further studies, the dynamics of the populations of these two species independently of each other and the physiological aspect of the salinity tolerance of these monogeneans will be explored.

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Computational Study of ansa-Group 14 Metallocenes

Jason S. Overby and Faith A. Corbo, Chemistry and Biochemistry

Bridged metallocenes of silicon, germanium and tin were investigated with DFT calculations. The bonding features and electronic structure of a number of bridged species were determined. Of particular interest was elucidating the nature of the metal-centered lone pair of electrons. The calculated structures were compared to previously reported unbridged complexes.

74

Physical Properties of the Charleston Harbor and Their Relation to Phytoplankton Distribution

Biology 342 classes and Carol J. Pride, Biology Dept. and Rachel D. McEvers, Geology Dept.

Data gathered during field trips taken in 2000 and 2001 characterize the spatial and temporal variations of physical properties in the Charleston Harbor and investigate their relation to phytoplankton distributions. Depth profiles of temperature, salinity, chlorophyll concentrations, percent light transmission, and irradiance
were produced at two sites during four sampling intervals. Density profiles indicate that pycnocline depth is dependent on salinity variations and fluctuates with the tides. Halocline structure at the two sampling sites suggests the estuary is partially mixed.

Turbidity maxima lie beneath the pycnocline suggesting that resuspended particles are trapped beneath the density gradient. The depth of the photic zone calculated for each site varied inversely with surface turbidity. Chlorophyll concentrations tended to be higher in the oceanic waters than in the overlying riverine waters, suggesting that the marine phytoplankton communities thrive better in the estuarine environment than do the fresh water phytoplankton.

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**Investigation of the Geologic Framework of the Grand Strand Coast of South Carolina**

Thomas R. Putney and Michael Katuna, Geology and Environmental Geosciences

Sixteen borings have been drilled to a maximum depth of sixty feet along 80 km of the Grand Strand coast of South Carolina, as part of a study of the geologic framework which underlies the present day beaches. The internal stratification, sediment texture, composition and faunal assemblages have been analyzed to determine the age and facies relationships of the younger surficial deposits. Additional data has been derived from interpretation of geophysical water well logs and power auger logs. This land-based data will be coupled with data from offshore seismic surveys to develop a model for the geologic framework. Several incised Piedmont river paleochannels have been identified in the subsurface beneath the present day coast.

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**Late Cretaceous (Maastrichtian) Paleofaunas From South Carolina**

Bryan B. England, Departments of Geology and Biology

The Peedee and Donoho Creek Formations of South Carolina represent a deltaic to marine shelf environment of Maastrichtian age (~70-65MYA). These formations have been known to fossiliferous since the mid-19th century, but their vertebrate faunas have been almost entirely ignored in the scientific literature. Collections made by the author over the last two years from the Peedee and Donoho Creek Formations in Florence and Horry Counties (SC), supplemented by collections from the Donoho Creek in the care of the Charleston Museum, reveal evidence of over twenty species of chondrichthyian and bony fishes, as well as marine turtles, crocodilians, mosasaurs, plesiosaurs, and, rarely, dinosaurs.

A macroinvertebrate fauna from the Peedee Formation was also recovered, including many species that have never been previously reported from this state. This vertebrate and invertebrate biostratigraphic data provides a basis for improved correlation with other marine formations of Late Cretaceous age throughout North America.

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### 77
Soap and XML for Distributed Systems

Nick Diamond, Erin King, Kaylinda Ward, Shon Mitchell, Mike Tyukhai, and D. Carey Coleman, Computer Science

SOAP (Simple Object Access Protocol) depends on the idea that any two computers on the Internet can communicate using HTTP, the protocol that powers the Web. It then transmits information using XML (Extensible Markup Language), the markup language that allows us to create tags and document standards. The server turns the incoming XML into an object method call and then turns the object's response into an XML document that is returned as the HTTP response. Since both HTTP and XML are open standards published by the World Wide Web Consortium, they can be implemented on a variety of platforms and thus interact without any trouble.

Solution of a Non-Linear Driven LRC Circuit

Russel Ross and Fred Watts, Physics & Astronomy

Solving the second-order differential equation that describes an LRC circuit with non-constant resistance and inductance. The solution to this second order non-linear differential equation will be found by numerical and mathematical means. An experimental setup was constructed with a variable inductance, resistance, and capacitance. We are testing whether or not the observed behavior of the circuit corresponds to the mathematical solution.

Physics Lab with Flavor

Mikhail M. Agrest, Physics & Astronomy

This work is dedicated to improving the effectiveness of the teaching-learning process. Objectives of the hands-on experience are discussed. An excited electron emits light. Eyes of an excited student shine when knowledge is acquired. Is there a more valuable reward for a teacher's efforts? Remember the old joke about science demonstrations: If the result of your experiment doesn't smell pleasant - it's Chemistry; if the subject is not alive - it's Biology; if it doesn't work, it's Physics. To make it work and to have students be able to predict the results is to guarantee success. This method was tested in Introductory Physics labs at the College of Charleston. The teaching-learning effectiveness has been increased and positive feedback was received from students and faculty at the College and at other universities. Learn how to bring flavor into any lab by making it a "shoot for your grade" type of lab.

Partial Determination of the Gene Sequence for Loblolly Pine Calreticulin
Calreticulin is a protein that plays an important role in calcium homeostasis in a wide variety of plant and animal cells. The well established critical role of calcium in pollen tube growth together with our recent observations that calreticulin gene expression is augmented during loblolly pine pollen germination, suggests that this protein may play a functionally important role in this process. While the complete nucleotide sequence of the calreticulin mRNA has been determined, sequence data for the calreticulin gene is currently lacking. Such data will be essential, not only for future gene regulation studies, but also for determining the number of different calreticulin genes and protein isotypes present in loblolly pine. In this project, calreticulin-specific primers and genomic DNA extracted from pine needles was used to PCR amplify a portion of the calreticulin gene. Sequence analysis performed on the PCR product revealed a stretch of the gene containing both intron and exon sequences.

**81**

**Reaction Products of Phenolic Compounds with Chlorine Bleach**

Mwende Kiambo, Maria C. Marsh, and W. Frank Kinard, Chemistry and Biochemistry

Chlorophenols are a group of compounds with toxic properties that are used as pesticides and antiseptics. They are also produced in the chlorine treatment of water and the bleaching of wood pulp in the paper making process. We have developed a series of simple experiments that make the chlorinated derivatives of phenol and cresols by the reaction of phenols with household chlorine bleach. This presentation will describe the stoichiometry of the reaction of active chlorine with phenol, the isolation and analysis of the chlorophenol products, and present details on the properties of the reaction products.

**82**

**The Effects of Chloro-dinitro Bezene on Human Lung Cancer Cells**

Jamie A. Groover and Lauren M. Wooley, Physics & Astronomy

On our poster, we hope to explain the results of our biomedical physics research. After much experimentation, it was concluded that 2, 4 chloro- dinitro benzene has a lethal affect on human lung cancer cells at particular levels. However, it has also been found that particular concentrations of 2, 4 chloro dinitro benzene is drawn into human living cancer cells without destroying the healthy viable cells. The poster will attempt to explain the significance of this finding and how the information can be used to further bone marrow research.

**83**

**Taylor Series Expansion for a Simple Pendulum**

T.William Bulkley and David Hall, Physics and Astronomy
A set of linked Taylor Series provides the basis for a numerical representation of the motion of a simple pendulum. The only free parameters are the initial angular position and initial angular velocity. The small angle approximation is not used.

84

Deletion of the homer2 gene blunts the incentive salience of cocaine-paired cues in mice

Kelly A. Frys, Biology

Molecular candidates mediating drug-induced neuroadaptations and their behavioural manifestations are likely those regulated by excitatory synaptic activity. Homer1-3 are three brain-specific genes, encoding the Homer family of proteins, which are known to scaffold mGluR1,5 receptors. Recently, mice homozygous for the homer2 gene deletion were developed and here I report on the role of Homer2 protein in mediating the rewarding effects of both drug and non-drug reinforcers. No observable genotypic differences were found with respect to operant responding for food pellets on a fixed progressive ratio schedule of reinforcement or the expression of place conditioning to food. In contrast, the presentation of contextual cues paired previously with cocaine (4 X 15 mg/kg, IP) did not produce place conditioning in homer2 -/- mice. Even when challenged with cocaine (15 mg/kg) and tested again within the context of the cues, the responses of homer2 -/- mice were lower than wild type littermates. This effect of homer2 deletion was not related to an inability of knock-out mice to detect cocaine; no genotypic differences were observed with respect to both the time-course and the dose-response function for cocaine discrimination. Given the proposed role for Homer proteins in synaptic plasticity, it is suggested that Homer2 protein may be critically involved in the neuroadaptations in the circuitry mediating the attribution of incentive salience to drug-related cues. (Supported by NIDA grant DA 30906).

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Effects on Global Temperature of Methane Emissions from Sea Floor Methane Hydrates

Jeff Jenkins and Laney Mills, Physics and Astronomy

Underwater methane gas at high pressures and low temperatures, such as those found in the ocean below 200 meters, will associate with water molecules and form a frozen ice-like lattice called methane hydrate. There are vast quantities of these hydrates throughout the world's oceans, and their mass could be greater than the total mass of all other fossil fuel reserves. Although these hydrates could be an energy bonanza used to replace our waning petroleum reserves, methane is a greenhouse gas with 10-30 times the heat trapping capacity of carbon dioxide. Ocean floor methane hydrates can be released through a variety of means including ocean warming and physical sediment disruption caused by mining or drilling. This poster will address the global warming aspect by presenting the results of computerized modeling estimates of the temperature increase over the next 100 years of various methane-release scenarios.
Merocyanine 540 Uptake by MRP2 Transporters

Ashley Kuklentz and Linda Jones, Astronomy and Physics

Photodynamic therapy (PDT) is a form of light-activated chemotherapy. PDT involves the use of a photosensitive drug and light to kill cancer cells. The excited drug gives its energy to oxygen in the tumor and makes the oxygen a strong oxidizer of membranes and organelles of the cancer cell. Merocyanine 540 (MC540) is a photosensitive drug that has an affect on cancer cells, but the mechanism of uptake is unknown. Malphigian tubules from crickets were used to show a model of transport. The tubules are a single layer of endothelial cells thick, and they function like a kidney in collecting and removing wastes. The inhibitor, 1-chloro-2,4-dinitrobenzene (CDNB), is a known inhibitor of MRP2 transporters that are in malphigian tubules. MRP2 transport is the way that cancer sells remove toxins. The goal of this project was to see if MC540 uses the MRP2 transport system in the cricket model. A confocal microscope was used to observe the lumen of the tubule. The fluorescence in the lumen was greater without the inhibitor than when the inhibitor was added. We concluded that MC540 is a substrate of the MRP2 transporter in the cricket model.

Inhibition of Transcription of the c-myc Gene by a Triple Helix-forming Oligonucleotide

Whitney Wolf and Stephanie Dellis, Dept. of Biology, and Eileen McGuffie, Giuseppina M.R. Carbone, and Carlo Catapano, Hollings Cancer Center, MUSC

The c-myc gene is important for cell differentiation and growth in normal cells, but is also found to be overexpressed in several cancers, including breast and prostate cancers. Previous studies have shown that triple helix-forming oligonucleotides (TFOs) targeted to specific sequences in the promoter region of this gene, can inhibit transcription. Incubation of cancer cells with the TFOs resulted in inhibition of cell growth and apoptosis. In this study, a TFO was designed to target a 27 bp homopurine-homopyrimidine sequence upstream of the P1 promoter site of the c-myc gene. This TFO was expected to inhibit transcription initiation of the c-myc gene by preventing binding of transcription factors to the promoter and inhibit proliferation of breast cancer cells that overexpress this gene. The effects of this TFO in breast cancer cells were studied using a luciferase reporter gene and cell viability assays. Reporter plasmids were constructed to contain either the P1 or both the P1 and P2 promoters in control of the luciferase gene. The plasmids were transfected with either the TFO or a control oligonucleotide into breast cancer MDA-MB-231 or MCF-7 cells. Luciferase assays showed inhibition of c-myc promoter activity as a result of triplex formation with the TFO. This study indicated that this TFO targeting a sequence upstream of the P1 promoter site was able to block c-myc activity and inhibit proliferation of breast cancer cells. The control oligonucleotide had minimal effects.

Effect of Instantaneous and Gradual Mass Loss on Planetary Orbits

James M. Fernandez and Jim Neff, Physics & Astronomy
I have modeled the effects of instantaneous and gradual change in the mass of a star on the bodies orbiting around it. Instantaneous mass change happens when an evolved star undergoes a supernova explosion. Gradual mass change occurs when a star becomes a giant star and ejects a planetary nebula, leaving behind a lower mass white dwarf. If the mass changes appreciably, a planet could possibly reach its escape velocity, thus leaving us with planets that are no longer gravitationally bound.