

GRADUATE STUDENT ASSEMBLY

PROUDLY PRESENTS

**17TH ANNUAL
RESEARCH SYMPOSIUM
OF VIRGINIA TECH**

TECHNOLOGICAL FRONTIERS

**MARCH 26, 2001
COMMONWEALTH BALLROOM
SQUIRES STUDENT CENTER**

Sponsored by: Graduate School, Student Budget Board, College of Arts and Sciences, College of Engineering, College of Natural Resources, College of Veterinary Medicine, Biological Sciences Initiative, Waste Policy Institute, University Honors Program, and Gamma Sigma Delta

The 17th Annual Research Symposium of Virginia Tech

The Graduate Student Assembly (GSA) is proud to host this symposium in order to provide graduate and advanced undergraduate students an opportunity to showcase their achievements in research. This book is a compilation of the abstracts submitted by this year's participants.

The GSA is an umbrella organization for the graduate students of Virginia Tech. The Research Symposium is one of the many activities of the GSA. Other activities include Graduate Research Development Project, Travel Fund Award Program, Graduate and Professional School Fair, and many more.

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Additional Graduate Education Week Events

Tuesday, March 27, 2001

Graduate Education Day

“The Big Issues for Big Science”

Featured Speaker: Dr. Bill Madia

Director, Oak Ridge National Laboratories and
Executive Vice President, Battelle Memorial Institute

Location: 2150 Torgersen Hall

6:30 p.m. reception preceding talk at 7:00 p.m.

Fourth Annual Student Research Day

10:00 am – 3:00 pm

Location: CHRE

Wednesday, March 28, 2001

“Living Downstream: An Ecologist Looks at Cancer and the Environment”

Featured Speaker: Sandra Steingraber, PhD

Location: Donaldson Brown Conference Center Auditorium, 7:30 p.m.

Preparing the Future Professional

Location: Squires Student Center, Brush Mountain Room

Academic Track: 9:00 a.m. to 12:30 p.m.

Business and Industry Track: 1:00 p.m. to 4:00 p.m.

Thursday, March 29, 2001

Graduate Student Appreciation Day

Friday, March 30, 2001

Graduate Student Awards Banquet

**For more information visit the Graduate Education Week website:
<http://www.rgs.vt.edu/grads/GraduateEducationWeek/index.html>**

**SPECIAL THANKS TO THE FOLLOWING
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**Additional thanks to Paula Williams for her help and support and
to the Judges who volunteered their time.**

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Agriculture and Animal Sciences

1. Fluthiamid plus Metribuzin and Chlorsulfuron plus Metsulfuron Control Italian Ryegrass (Lolium multiflorum)

Andy Bailey

Field experiments were conducted in 2000 to evaluate wheat response and Italian ryegrass control from fluthiamid plus metribuzin (Axiom) and chlorsulfuron plus metsulfuron (Finesse). Fluthiamid plus metribuzin controlled Italian ryegrass 84 to 89% 2 mo after treatment regardless of the rate or application timing used. Substantial wheat injury from fluthiamid plus metribuzin PRE or SPIKE resulted in significant decreases in wheat yield (18 to 30%) when compared to diclofop PRE and did not improve yield compared to the nontreated control. Italian ryegrass control from fluthiamid plus metribuzin PRE was comparable to diclofop PRE and was higher with SPIKE applications. Chlorsulfuron plus metsulfuron alone and in combination with fluthiamid plus metribuzin controlled Italian ryegrass 64 to 75% 2 mo after PRE applications and generally increased to 82 to 90% with 2-leaf applications. Wheat treated with chlorsulfuron plus metsulfuron alone produced yields that were comparable to those from diclofop and higher than the nontreated control. However, treatments that contained fluthiamid plus metribuzin did not significantly improve wheat yield above those of the nontreated control. Both fluthiamid plus metribuzin and chlorsulfuron plus metsulfuron alone and in combination were generally effective in controlling Italian ryegrass.

2. Topical Antimicrobial Effects on Equine Distal Limb Wound Healing

Douglass B. Berry II

Objective- To determine the effects of the topical antimicrobials silver sulfadiazine and povidone-iodine ointment on equine distal limb wounds that heal by second intention. Animals- 6 healthy adult horses Procedure- Six 2.5 cm² standardized skin wounds were created. Each wound was exposed to a single treatment: 1.0 % silver sulfadiazine cream bandaged (SSD-B), 1.0 % silver sulfadiazine slow release matrix bandaged (SDX-B), 1.0% silver sulfadiazine slow release matrix not bandaged (SDX-NB), povidone-iodine ointment bandaged (PI-B), untreated control bandaged (C-B) and untreated control not bandaged (C-NB) until healing. Wound area, granulation tissue area and perimeter were measured with planimetry software from digital images obtained at each observation. Exuberant granulation tissue was excised when present. The days until healing, rate of healing parameter, rate of contraction and epithelialization were compared among groups. Results- The healing parameters and mean days to healing did not statistically differ between any groups ($P>0.1$). Healing occurred from 83 days for the C-B and PI-B to 101 days for C-NB. All bandaged wounds produced exuberant granulation tissue compared to none of the unbandaged wounds. Conclusions and Clinical Relevance- Neither povidone-iodine nor silver sulfadiazine significantly effect healing when considering the clinical rationale for their use.

3. Mammogenic effects of growth hormone and estrogen are mediated by an increased mammary IGF-1: IGFBP-3 ratio

Sarah Berry

An epithelium-free mammary fat pad was prepared in twenty-five Friesian heifer calves. At 18 months of age, heifers were assigned to one of four treatment groups: control (C), growth hormone (GH), estrogen (E) or growth hormone + estrogen (GE). Hormones were administered for 40 hours before the animals were sacrificed to provide mammary samples of parenchyma (PAR), intact fat pad (MFP), and epithelium-free or "cleared" fat pad (CFP). IGF-1 and IGF binding protein-3 (IGFBP-3) mRNA was higher in CFP and MFP than PAR whereas the proteins were higher in PAR. E and GH increased incorporation of 3H-thymidine into DNA of PAR by 350% and 125% respectively. Coincident with the changes observed in mammary epithelial proliferation, E increased IGF-1 protein by 190%, 40% and 60% in MFP, PAR, and CFP, respectively. E increased IGF-1 mRNA levels in MFP, but not CFP, indicating that IGF-1 expression is modulated by adjacent epithelium. GH and E reduced IGFBP-3 content in PAR to less than 40% of controls, whereas the 24-kDa IGFBP in CFP and MFP was increased to between 40% and 150% of controls. Increased proliferation of mammary parenchymal cells was associated with an increased ratio of local mammary IGF-1: IGFBP-3.

4. Institutional Configuration of Agricultural Extension in South-Eastern Europe: A Conceptual Framework

Lefter Daku

Following the economic reforms in the early 90's, most of the south-eastern European countries (SEE) made efforts to establish agricultural extension services. However, a number of factors including tight governmental budgets, lack of experience, and the existence of vested interests have constrained the development of extension services. This paper examines the rationale for public funding of extension programs and evaluates the incentive structure for private and public sector participation in providing an agricultural extension service in the SEE countries. It sets out a medium and long-term approach with a primary focus on institutional dimensions. Two groups of factors that affect the private sector supply of extension are analysed: (i) demand and supply-side factors that affect the profitability of the service and (ii) factors arising from the public good nature of extension output, externalities, moral hazards, and economies of scale that affect the appropriability of returns of the service. The main conclusion derived from this study is that the SEE countries should try to achieve a public-private extension balance by following a more gradual approach toward privatisation of agricultural extension service. However, the paper advocates a phased withdrawal of the public sector from providing extension in areas that may be best served by private sector while recognising a continued important role for the public sector to correct for undesirable effects of private extension.

5. A Non-necrotic Mechanism of Resistance to Soybean mosaic virus from Peking, PI 88788 and V94-5152 Soybean Lines is Restrictive to Viral Infection and Movement.

Amer Fayad

Resistance to Soybean mosaic virus (SMV) in soybean (*Glycine max* [L.] Merr.) is controlled by single dominant genes at three distinct loci, based on genetic studies and responses to SMV pathotypes. The mechanism of resistance at one of these loci, found in Peking, PI 88788 and V94-5152 derived from PI 486355, was investigated. Greenhouse-grown plants of each line were inoculated with different SMV strain groups to monitor events during the infection process. Leaves were sampled over time and tested for SMV presence by immuno-printing. Decreases were observed in number of infection sites and extent of viral movement, both cell-to-cell and long-distance, in comparison to cultivars that were susceptible or carrying R genes at a different locus. This resistance is non-strain-specific, non-necrotic to any strain, and its mechanism involves limiting and delaying local and systemic invasion. The resulting late susceptible phenotype has not been observed with any other R gene in soybean.

6. Type-2 Porcine Circovirus (PCV-2) Associated with Postweaning Multisystemic Wasting Syndrome (PMWS) in Pigs: Genetic Characterization and Development of a Differential PCR-RFLP Diagnostic Assay

Martijn Fenaux

The objectives of the study were to genetically characterize PCV-2 and to develop a PCR-RFLP assay to detect and differentiate between infections caused by PCV-2 and the non-pathogenic PCV-1. The complete genome of six North American isolates of PCV-2 from different geographic region were amplified and sequenced. Sequence analyses showed that the PCV-2 and the non-pathogenic PCV-1 shared only about 70% nucleotide sequence identity. The PCV-2 genome is relatively stable but genetic variation was observed among isolates from different geographic regions. Phylogenetic analysis revealed two distinct genotypes: nonpathogenic PCV-1 and PMWS-associated PCV-2. Within the PCV-2 genotype, several minor branches that were associated with geographic origin were also detected. Based on the genetic characterization, we further developed a PCR-RFLP assay capable of both detecting and differentiating infections caused by PCV-2 and/or PCV-1. The observed genetic variation among PCV-2 isolates from different geographic regions may have important implications in PCV-2 diagnosis and research. The PCR-RFLP assay developed in this study will be very useful in PCV differential diagnosis.

7. Evaluation of Quality Properties of Butter and Ice Cream with a High Content of Linoleic and Oleic Acid

Sonia Gonzalez

Milk fat composition determines specific properties of dairy products such as texture, flavor and oxidation rates. Previous studies have shown that milkfat containing higher levels of polyunsaturated fatty acids have lower melting point and lower solid fat content leading to softer textured products. Three different milkfat compositions were obtained through dietary manipulation of cows: high oleic, high linoleic and standard milkfat. Ice cream and butter were

processed from the different milkfats. The samples were analyzed to measure differences in texture (firmness), oxidation rate and sensory perception. Untreated butters were firmer than butters containing higher amounts of unsaturated fatty acids. Peroxide values in ice cream were measured to monitor oxidation behavior of the three treatments. After several months of storage the peroxide values increased at a higher rate for the linoleic treatment. Sensory analyses included a scooping test on the ice cream samples to detect differences in texture. An overall difference test determined if consumers could taste a difference between the three ice cream treatments. Significant difference was found between the control and the oleic treatment as well as the control and linoleic treatment at a $p=0.05$. No significant difference was found in the scooping test.

8. Isolation and Characterization of a myo-Inositol-1-Phosphate Synthase (mIPS) gene family in soybean.

Laura Good

Phytate (myo-inositol hexakisphosphate) is the major storage form of phosphorus in most seeds; in soybean 60-80% of total phosphorus is sequestered as phytate. Non-ruminants are unable to cleave phytate, therefore the majority of phosphorus in soybean meal is nutritionally unavailable, and feed must be supplemented with phosphorus. Phytate also acts as an antinutrient, chelating essential minerals and proteins within the digestive tract of non-ruminants. Application of phytate containing poultry and swine manure to the soil as fertilizer leads to phosphorus pollution of watersheds, leading to eutropication of lakes, streams and ponds. To reduce phytate levels in soybean seeds, an enzyme in the biosynthetic pathway of phytate, myo-Inositol-1-Phosphate Synthase (mIPS), will be downregulated using an antisense strategy. mIPS cDNA from developing soybean seeds has been isolated and sequenced. The intron-exon structure corresponding genomic clone has been determined. Southern blot analysis of soybean DNA indicates that several isoforms of the mIPS gene are present in the soybean genome. Analyses of soybean EST sequences suggest a total of four mIPS genes. Western analysis of total protein and Northern analysis of RNA indicate that a mIPS isoform is expressed very early in seed development. In order to create an isoform-specific antisense construct, the promoter of the seed-specific mIPS will be isolated through screening of soybean BAC clones. Generation of promoter-GUS fusions and bombarding into developing soybean seeds will identify regions important for promoter function. Once identified, the promoter sequence will be used to control expression of mIPS cDNA sequence in the sense and antisense orientations.

9. Determining Sources of Fecal Pollution in Water for a Rural Community

Alexandria Graves

This project involves developing and applying bacterial source tracking (BST) methodology to determine sources of fecal pollution in water for a rural community (Millwood, VA). Antibiotic resistance analysis (ARA) is the primary BST method for fecal source identification, followed by randomly amplified polymorphic DNA (RAPD) analysis for confirmation. Millwood consists of 71 homes, all served by individual septic systems, and a stream (Spout Run) passes through the center of the community. Spout Run drains a 5,800 ha karst topography watershed that includes large populations of livestock and wildlife. Stream and well samples were collected monthly, starting in 5/99, and analyzed for fecal coliforms and fecal streptococci. To date, 18% of the well

samples and 95% of the stream samples were positive for fecal coliforms, and 28% of the stream samples exceeded the recreational water standard (1,000 fecal coliforms/100 ml). ARA of fecal streptococci recovered from the stream samples indicated that fecal sources above Millwood were all livestock (~60%) and wildlife (~40%) in origin. Isolates of human origin appeared as the stream passed through Millwood (~20% human, ~25% wildlife, and ~55% livestock), and the percent human origin isolates declined downstream from Millwood. These results were obtained by comparing the antibiotic resistance profiles of stream isolates against a library of 1,175 known source isolates with correct classification rates of 94.6% for human isolates, 93.7% for livestock isolates, and 87.8% for wildlife isolates.

10. Characterization of host plant defense responses to parasitization by Orobanche

Amanda Griffitts

Orobanche is a parasitic plant that attacks the roots of many important crops. Orobanche penetrates the host root and forms connections to the host vascular tissue, from which it will draw all of its water and nutrient requirements. To investigate how parasitization effects host defense pathways, we are studying the patterns of expression of host genes known to be involved in aspects of plant defense response. These include two genes of the isoprenoid pathway, one of which is expressed in wounded tissue (*hmg1*), and another that is induced in response to wounding yet repressed in response to pathogen elicitors (squalene synthase). A third gene (*PR-1a*) is specifically induced in response to pathogen attack as part of the systemic acquired resistance (SAR) response. Plant gene expression was studied using transgenic tomato plants containing *hmg1*-GUS fusions, and northern hybridization analysis of tobacco roots using gene specific probes. Results indicated that expression of *hmg1* is induced, squalene synthase is repressed, and *PR-1a* is not affected in tissue parasitized by Orobanche. Together, these results indicate a complex response to the parasite. Whereas *hmg1* induction is consistent with Orobanche inflicting a simple wound-like injury, the repression of squalene synthase is consistent with plant recognition of a pathogen attack. In contrast, the failure of Orobanche to induce SAR-related *PR-1a* indicates an ability to avoid inducing some defense-related pathways. By comparing the regulation of these defense genes in response to Orobanche attack, we are able to gain a greater understanding of host response to parasitization.

11. Dietary Vitamin B6 Supplementation and Chemically-Induced Mammary Carcinoma in Rats

Lisa Hobbs

Previous work from our lab has shown that vitamin B6 (B6) supplementation dramatically decreases the growth of human mammary carcinoma cells in vitro. Therefore, it was the objective of this study to determine the effects of dietary B6 supplementation on 7,12-dimethylbenz(a)anthracene (DMBA)-induced mammary carcinoma in rats. Specifically, we aimed to identify the effect of pyridoxine (PN) supplementation on tumor growth and vitamin uptake by tumor cells. To accomplish this, 50 d old female Sprague Dawley rats were gavaged with 15 mg DMBA in 1 mL of sesame oil. The rats were then randomly divided into 3 groups and fed a diet containing either 7, 350, or 1050 mg PN/kg diet, the equivalent of 1, 50, or 150 times the NRC B6 requirement for rats, respectively. After 12 wks the 1050 mg PN/kg group had an average of 1.39 tumors/rat, while the intermediate group had 1.5, and the 7 mg group had

1.57. In this ongoing 18 wk study, no statistically significant differences in tumor incidence or latency have been observed to date. Tumor B6 concentrations will be assessed at the termination of the study to determine whether differences in vitamin uptake occurred. Supported by American Cancer Society Grant #IRG-99-225-01.

12. Genetic Basis for the Outbreaks of Porcine Reproductive and Respiratory Syndrome (PRRS)

K. F. Key*, G. Haqshenas, D. K. Guenette, T. E. Toth, and X.J. Meng

Swine herds have experienced recent outbreaks of a severe form of PRRS (designated acute PRRS) characterized by abortion and high mortality in pregnant sows. Most of the affected herds had been vaccinated with modified-live vaccines (MLVs) against PRRS virus (PRRSV). The objective of this study was to explore the possible mechanism for the emergence of acute PRRS. The major envelope genes (ORF5) of eight acute PRRSV isolates were amplified and sequenced. Sequence analyses revealed that these acute PRRSV isolates shared 87-97% nucleotide sequence identities with other known North American PRRSV isolates and the MLVs. One of the acute PRRSV isolates (98-37120-2) is very closely related to that of the RespPRRS MLV, with 97% nucleotide sequence identity. Phylogenetic analysis revealed that all eight acute PRRSV isolates are clustered within the North American genotype, and the acute isolate 98-37120-2 is most closely related to the RespPRRS MLV and several Danish isolates that were confirmed to be derived from the RespPRRS MLV. The data from this study suggest that the emergence of acute PRRSV may be due to accumulated genetic changes of earlier PRRSV isolates or reversion of MLVs to a pathogenic phenotype. This study has important implications for vaccine efficacy and development.

13. Genetic Engineering Strategies to Enhance Parasite Resistance

Eugenia McMeans

The sedentary endoparasitic nematodes, root-knot (*Meloidogyne* spp.) and cyst (*Heterodera* and *Globodera* spp.) nematodes, and the parasitic angiosperm, Egyptian broomrape (*Orobancha aegyptiaca* Pers.), are obligate root parasites that cause severe losses in agriculture. Over 80 billion dollars per year world-wide can be attributed to infections caused by these sedentary endoparasitic nematodes. Parasitism by Egyptian broomrape can significantly reduce the yield and quality of crop hosts. Although these are two diverse classes of parasites, they have significant similarities among their mechanisms of parasitism and complex interactions with their hosts and are difficult to control through traditional agricultural approaches. The goal of this research is to develop genetic engineering strategies to enhance resistance to these representative parasites. For nematode resistance, the nematode-inducible promoter, tomato (*Lycopersicon esculentum* Mill.) *hmg2*, and the gene encoding tomato proteinase inhibitor I, which blocks nematode feeding, will be used. Two distinct *Orobancha* -responsive promoters will be used to induce the co-expression of an avirulence gene-resistance gene pair in transgenic tobacco. The simultaneous activation and expression of these genes produce a localized hypersensitive response, thus preventing successful development of the parasitic weed.

14. Soy Isoflavone Supplementation Does Not Alter Immune Function in Postmenopausal Women.

Paes CM*, Girmes-Grieco NK* & Davis BA.

A growing body of evidence has demonstrated that soy isoflavone consumption may protect against the development of cancer and this could be linked to isoflavone-induced alterations in immune function. The purpose of this double-blind, placebo-controlled, 4-wk intervention trial was to investigate whether supplementation with soy isoflavones altered parameters of immune function in postmenopausal women. Twenty healthy women (50-69 yr), who were not on hormone replacement therapy, were randomly divided into an experimental group (n=10) consuming 100 mg of soy isoflavone/day for 4 wk and a control group (n=10) receiving placebo tablets. Fasting blood samples were drawn at baseline and on d 28 to assess circulating lymphocyte distribution, natural killer cell cytotoxicity, lymphocyte proliferation, and cytokine production. Plasma concentrations of genistein and daidzein were quantified at baseline and on d 28 using reverse-phase HPLC. Despite high individual variability among subjects, there was a significant increase ($p < 0.008$) in plasma isoflavone concentration in the experimental group. However, all immune parameters measured remained unchanged after 4 wk of supplementation and did not differ between the two groups. In conclusion, this study suggests that soy isoflavone supplementation does not alter immune function in postmenopausal women and also suggests that the cancer protective effect of soy may not be mediated through enhanced immune defense.

15. Sensory and Analytical Analysis of Milk Formulations with Sweet Cream Buttermilk

Jodi Powell

The sensory and analytical characteristics of three dairy beverages were analyzed using two underutilized dairy products, liquid sweet cream buttermilk and dried sweet cream buttermilk, with skim to produce two lowfat (.5%) formulations. A hedonic test was used to measure the overall acceptability of these products as compared to skim milk, and the "just right" test was used to determine if there was a significant difference in flavor color and viscosity among the three samples. Sensory characteristics of nonfat milks were enhanced or changed by adding the liquid buttermilk and the dried buttermilk. The hedonic test showed that on an increasing scale from likes extremely to dislikes extremely, the skim milk scored a five, the liquid buttermilk formulation scored a 4, and the dried buttermilk formulation scored a nine. These results showed the liquid buttermilk formulation was more acceptable than the traditional skim or the dried buttermilk formulation. The average value for the "just right" test with 3 being "just right" showed that for the previously mentioned attributes, the cream and liquid buttermilk were "just right" and the dry buttermilk was evaluated above the "just right" score with a score of 4. Solid Phase Microextraction-Gas Chromatography/Mass Spectrometry was used to elucidate key flavor compound susceptible to light oxidation.

16. Using a Geographic Information System as a Tool to Improve the Integrated Management of Barley Yellow Dwarf in Virginia Wheat

Peter Sforza

Fifty-three wheat fields were surveyed in twenty-one eastern Virginia counties to document the incidence and severity of barley yellow dwarf (BYD) and other diseases in the spring of 2000.

BYD is the most important virus disease of cereals worldwide. In Virginia wheat, yield losses for a plant infected with barley yellow dwarf have been estimated at thirty percent (Herbert et al., 1999). The occurrence of BYD is related to many aspects of the hosts, virus, vectors, and the environment. A geographic information system (GIS) will integrate the georeferenced biological survey data with numerous data sources including SSURGO soil data elements, weather maps, land cover maps, and historical crop information. Fields at risk for BYD may be identified by using statistical analyses and GIS as an epidemiological tool. This approach may permit local assessment of risk and more focused management strategies based on identification of elements associated with high BYD incidence.

17. Innovative Production and Marketing Systems to Provide Small Farmers with Sustainable Job and Income Opportunities

S. Sink*, C. Coale, G. Haugh, and D. Reaves

Farm income and agricultural sustainability are inter-related concepts, that are currently experiencing difficulty on Virginia farms. The decline in farm income and sustainability can be attributed to a variety of issues consisting of reductions in production quotas, oversupply of commodities, and rising production costs. Due to this decline of farm income and agricultural sustainability, a cooperative agreement was formed between federal, state, and local governments to explore different agricultural opportunities for small farmers and to develop an evaluation tool that would assess each identified opportunity. The development of this methodology was focused on the Southside Region of Virginia, however the methodology used can easily be applied to other communities in Virginia and the country. The success or failure of the product or service applied will be reported back to the community in the form of brief fact sheets, which will contain production, marketing, community, and profitability aspects of the product or service. When evaluating these options small farmers need to assess the benefits the product or service offers to their operation, to their community, and to their environment. By providing a tool that small farmers can use to evaluate the different agricultural options available to them, agricultural sustainability as well as community sustainability will be strengthened.

18. Selenium Protection against Mercury Toxicity in Dolphin Cells In Vitro

Amy (Hui-Shan) Wang

Marine mammals have low susceptibility to mercury toxicity, and selenium may contribute to this high tolerance based on the equimolecular accumulation of mercury and selenium in marine mammal tissues. To understand selenium-mercury interaction in cetacean cells, we investigated the effects of sodium selenite (Na_2SeO_3) on cell proliferation and cell death (including apoptosis, oncosis, and necrosis) on Atlantic Spotted Dolphin renal cells (Sp1K cells). Concurrent exposure to $80 \mu\text{M}$ Na_2SeO_3 provided full protection against $20 \mu\text{M}$ HgCl_2 -induced decrease in cell proliferation. Pretreatment with Na_2SeO_3 increased the protective effects of selenium administered later in conjunction with mercury, but pretreatment alone did not provide protection against mercury given alone. Furthermore, Na_2SeO_3 administered after the exposure to HgCl_2 did not protect cells. Earlier pre-mixed mercury and selenium solutions were less cytotoxic than freshly mixed solutions. These data suggested that the coexistence of Na_2SeO_3 and HgCl_2 was essential for the protective effects of Na_2SeO_3 against the toxicity of HgCl_2 . The protection may involve forming a non-toxic (or less toxic) selenium-mercury complex with/without competing binding sites. Na_2SeO_3 and HgCl_2 may bind to the same binding sites which modulate adverse effects on cells by mercury, but not by selenium or a mercury-selenium complex. Alternatively, the complex may not bind but still remove free, reactive mercury. Additionally, HgCl_2 -induced apoptosis in Sp1K cells was prevented by the concurrent exposure to Na_2SeO_3 . This may also contribute to the *in vivo* protection. This is the first report addressing the mechanism of mercury-selenium antagonism in cetacean at the cellular level.

19. Influences of Spatial Variability on Gall Midge Incidence in Jamaican Hot Pepper Production

Ryan Williams

Jamaican farmers are experiencing constraints to hot pepper (*Capsicum chinense*) export production due to a quarantine pest -- the gall midge (*Contarinia lycopersci*). USDA-APHIS perceives a threat of gall midge introduction into the United States, where the insect pest is not known to occur. This research tests the significance of a range of variables to gall midge incidence. The purpose was: 1) to explain the spatial patterns that result from the relationships between gall midge incidence in hot pepper production and production methods and/or environmental conditions, and 2) to determine if the variables that influence those patterns are related to variation in production scale. There were three components to the sample of 48 farm visits: the interview, the hot pepper sampling, and the measurements of physical and locational attributes. Producers responded to questions about production methods, marketing, and quarantine issues. The percent of infested fruits per plot was calculated. GPS was used to record farm location. Using ArcView, environmental and climatic datasets were overlaid with farm locations and their attributes. Multiple regression was used to measure significance of variables to gall midge incidence. There was significant affect on incidence by farm elevation, quarantine awareness, and intercropping in pepper plots.

20. Identification of Extrahepatic sites of Replication of the hepatitis E virus (HEV) in a Swine Model

Trevor Williams

HEV is an important human pathogen worldwide. Due to the lack of an animal model, the pathogenesis of HEV is poorly understood. Our recent discovery of a swine HEV in pigs affords us an opportunity to study HEV in a swine model. HEV is transmitted fecal-orally but how the virus reaches the liver is unknown. The objective of this study is to identify potential extrahepatic sites of HEV replication. Fifty-four pigs were randomly assigned into 3 groups: 18 pigs (group 1) were inoculated with swine HEV, 19 pigs (group 2) with human HEV and 17 pigs (group 3) as controls. Two pigs from each group were necropsied at 3, 7, 14, 20, 27, and 55 days postinoculation (DPI). Thirteen different tissues and organs collected during necropsies were tested by a negative strand-specific RT-PCR for HEV. In addition to the liver, replicative negative-strand HEV RNA was also detected from 3 to 27 DPI in colons, small intestines, hepatic and mesenteric lymph nodes. This is the first report demonstrating HEV replication in extrahepatic sites, and the results have important implications for HEV pathogenesis and xenotransplantation.

Engineering

21. Fire Response of Mechanically-Loaded Composite Structures - Experiments and Modeling

Jason Burdette

The durability of load-bearing structures exposed to fire is an issue of great concern in many engineering fields (especially the military, transportation, and construction fields). Because of the relatively small amount of work that has been directed at this subject in the past, an extensive research effort has been undertaken to study (both experimentally and analytically) the behavior of structures simultaneously exposed to fire and mechanical loading. The experiments developed for this study are unique in that they are the first in which a real flame source is used to generate the fire conditions. The analysis is unique in that it is the first attempt to integrate a string of sophisticated computer models to simulate the entire fire exposure process (beginning with fire evolution, continuing through material degradation and local stress re-distribution, and ending with structural failure). Details of the novel experimental set-up and procedures will be presented. Development of the models used for the analysis will be described. Results of both the experiments and model predictions will be presented and the significance of the findings will be highlighted.

22. SIMULATION OF GAS AND FIBER NETWORK FOR VIRGINIA

UJVAL GANDHI

With the ever-increasing demand for high quality, high reliability electric power, it is of prime importance to determine and predict Virginia's usage and demand of electricity over the next decade to retain VA's lead in e-business investment. To achieve this, a web-based simulation network is being constructed having a javascript entry form giving data to an Arena simulation network which further outputs simulation in mdb format to MapPro 6 which will give topographical maps. In this way, any web-enabled user can identify VA's gas (primary source of electric power) and fiber network to locate the e-businesses. Planning policy makers can view alternative arrangements and locate power plants accordingly.

23. Photonic Crystal Devices

Keith Huie

In conventional optical waveguides (fibers), the transmission of light around tight bends has been literally unfathomable because of the considerable amounts of radiation loss encountered while propagating through the medium. This has been the limiting factor when designing optical devices, since the waveguide networking consumes most of the viable circuit area. This issue has paved the way for the development of photonic crystal waveguides. When an electromagnetic wave is incident on the PC structure, the formation of a photonic band gap (PBG), which is capable of prohibiting a range of frequencies, can occur. If a "defect" is introduced, disrupting the periodicity of the structure, localization of light is achieved, forming a path for the light to propagate through. Since neighboring crystals, which prohibit the

propagation of light, because the path radiation loss is substantially reduced and the light propagates unperturbed through the medium. This path is known as the photonic crystal optical waveguide.

24. POWER ELECTRONICS: A PATH-BREAKING APPROACH

SUDIP MAZUMDER

Power electronics is a field of immense importance with applications ranging from microprocessor to (complex) distributed power supplies. The prevalent procedure for analyzing the stability of switching converters is based on small-signal models that require a smooth averaged model. Yet there are systems (in active use) that yield a non-smooth averaged model. Even for systems for which smooth averaged model is realizable, small-signal analyses of the nominal solution/orbit do not provide anything about three important characteristics: region of attraction of the nominal solution, dependence of the converter dynamics on the initial conditions of the states, and the post-instability dynamics. Clearly, there is a need to analyze the stability and dynamics of power converters from a different perspective and design nonlinear controllers for such hybrid systems. Our research, for the first time in the history (60 years) of power electronics develops systematic and correct methodologies for analysis and control of "ANY" power-electronic system by treating it as a nonlinear, discontinuous, and hybrid system. We have experimentally verified our theory on several different systems. We strongly believe that our results will redefine and provide new guidelines for the design and development of new systems in both industrial and academic environment.

25. DAY-OF-WEEK AND TIME-OF-DAY ANALYSIS OF CRITICAL INCIDENTS

Erik Olsen

The purpose of this analysis was to examine the effects of day-of-week and time-of-day on the number and severity of critical incidents occurring at intersections. A sampling of incident occurrence data from two intersections, a town environment and a city environment, were used. Analyses were performed to provide an indication of trends that might be independent of traffic count. It is concluded that effects of time-of-day and day-of-week are not profound. Considering that the numbers of incidents decrease in the evening as the week wears on, data should be gathered earlier in the week. However, to insure that all eventualities are covered, data should also be gathered for the remainder of the workweek, at least. It does appear that increasing traffic count has a mild increasing effect on number of incidents. Thus, data gathering should be concentrated at times of peak traffic. However due to rushes throughout the day data should be sampled throughout the day to obtain a comprehensive data set. We are led to the conclusion that data gathering should definitely be done early in the week and at high traffic times. However, all days and all rushes should be represented in the data set.

26. Simulation Study of an ADSL Network Architecture: TCP/IP Performance Characterization and Improvements using ACK Regulation and Scheduling Mechanisms

Kaustubh Phanse

Asymmetric digital subscriber line (ADSL) is a broadband access technology capable of delivering large bandwidth over existing copper telephone line infrastructure. This research aims at characterizing and analyzing TCP/IP performance in presence of a new protocol stack (TCP/IP over PPP and ATM) being promoted for one of the ADSL network architectures. Using extensive simulations, we verify the adverse effects of asymmetric links on the performance of TCP in presence of both unidirectional and bi-directional data transfer and the additional throughput degradation caused by the overhead at the AAL5-ATM layers. We quantify the improvement in the throughput obtained by delaying the TCP ACKs and by TCP/IP header compression. These techniques being effective for unidirectional traffic over asymmetric links, however, do not prove as effective when ATM enters the scenario or in presence of bi-directional data transfer. Further, we implemented the Smart ACK Dropper (SAD), a technique to regulate the flow of TCP ACKs. Considerable improvement in performance especially in the presence of unidirectional data transfer is achieved using the SAD technique. Although the improvement is to a lesser extent in the presence of bi-directional data traffic, SAD helps the network in quickly recovering from the impact of ACK compression. Further improvement in performance is achieved by using SAD in conjunction with certain differentiated service and policing mechanisms such as priority queuing, custom queuing and committed access rate.

27. PERSONAL AREA NETWORKS (PAN) : Realization of Near-Field Intra-Body communication

Vaidyanathan Ramasarma

As electronic devices become smaller, lower in power requirements, and less expensive, we have begun to adorn our bodies with personal information and communication appliances. Such devices include cellular phones, personal digital assistants (PDAs), pocket video games, and pagers. Currently there is no method for these devices to share data. Networking these devices can reduce functional I/O redundancies and allow new conveniences and services. The concept of Personal Area Networks (PANs) is presented to demonstrate how electronic devices on and near the human body can exchange digital information by capacitively coupling picoamp currents through the body. A low-frequency carrier (less than 1 megahertz) is used so no energy is propagated, minimizing remote eavesdropping and interference by neighboring PANs. A prototype PAN system allows users to exchange electronic business cards by shaking hands. The ability to share data increases the usefulness of personal Information devices, providing features not possible with independent isolated devices. The scenario requires the user to wear a device that periodically transmits a unique user code to allow a nearby stationary transceiver to identify locate and exchange messages with the user's device.

28. Tracing the path of Electric Power Flow

Sebastian Rosado

The final goal of deregulation in electric power systems is to allow customers choose their energy provider. Tracing the flow of electricity in power systems is an old issue, but it has become important now especially after the deregulation. There is no simple solution to this problem because clearly it is not possible to identify the electrons originating from each generator. If this could be done it would be possible to trace the flow of electric power in a network in a definitive manner. However, it is possible to approach the desired goal with the implementation of the tracing algorithms discussed in this work. Till now, the issues related with the electricity path are generally solved by employing the DC distribution factors method. Recently, two other methods have been proposed for tracing the flow of electric power. This work analyzes the methods based on their assumptions and simulation results for different systems. The reliability of the different methods is then discussed. A methodology for improving the results of electricity tracing is proposed

29. Quasi-Static and Fatigue Crack Growth of an Elastomeric Material Using a Modified DCB

Joseph South

In the present research, the crack growth of an elastomeric material was studied under quasi-static and fatigue conditions using a modified double cantilever beam specimen [1]. It was determined that the DCB arrangement best represented the state of stress in a rolling tire. To form the DCB specimen a thin layer of a carbon black filled natural rubber compound was cured between two rigid adherends. The strain energy release rate of the elastomer was calculated from the quasi-static crack growth. Under quasi-static conditions the crack front demonstrated a stick-slip crack growth. Unlike conventional crack growth testing for elastomers, such as the edge crack, the DCB arrangement imposes a plane strain condition within the elastomer. For the fatigue data the crack growth rate as function of the change in the strain energy release rate was calculated. It was found that the fatigue data were well represented by a Paris-Law expression. The plane strain crack growth rate was found to be two orders of magnitude higher than the plane stress crack growth rate. Interpretations of the data will be presented. [1] Lefebvre D.R., Dillard D.A., Brinson H.F. "The Development of a Modified Double-Cantilever Beam Specimen for Measuring the Fracture Energy of Rubber to Metal Bonds," *Experimental Mechanics*, 28, No. 1, March 1988, pp. 38-44

30. Image Segmentation and Range Estimation using a Moving Aperture Lens

Anbumani Subramanian

Given 2D images, it still remains a big challenge in the field of computer vision to group the image points into logical objects (segmentation) and to determine the location of locations in the scene (range estimation). Despite the decades of research, a single solution is yet to be found. Through our research we have demonstrated that the solution is to use moving aperture lens. This lens has the effect of introducing small, repeating movements of the camera center so that objects appear to translate in the image, by an amount that depends on distance from the plane of focus. Our novel method employs parallax scanning and optical flow techniques to an image sequence, captured using an auto-stereoscopic camera with a moving aperture lens. For a stationary scene, optical flow magnitudes and direction are directly related to the three-dimensional object distance and location from the observer. Exploiting this information, we successfully extracted objects at different depths and estimated the locations of objects in the scene, with respect to focus. Our work demonstrates an uncanny ability for passive range estimation, without emitting radio-frequency energy in an environment. Other potential applications include video compression, teleconferencing and autonomous vehicle navigation.

Natural and Biological Sciences

31. Efficacy of selected chemicals on the attachment and survival of Campylobacter jejuni on chicken breast skin

F. Arritt*, J. Eifert, M. Pierson, S. Sumner

Campylobacter infections have been linked to poultry in many outbreaks primarily with the consumption of raw or undercooked chicken. Campylobacter is the number one cause of acute bacterial gastroenteritis in humans in the United States with Campylobacter jejuni being responsible for 80-90% of those infections. The population of bacteria on the breast skin has been reported to be greater than on other edible portions of the chicken carcass making this an important site to control the organism. This research examined the efficacy of sprayed solutions of trisodium phosphate (10%), cetylpyridinium chloride (0.1% & 0.5%), acidified sodium chlorite (0.1%), Tween 80 (polysorbate 80) (1%) and hot water (50°C) for inactivating Campylobacter jejuni after inoculation onto chicken breast skin. Additionally, the relative ability of these chemicals to prevent attachment of Campylobacter jejuni was studied. All chemicals were evaluated using contact times of 30 sec, 3 min or 10 min. Results indicated a highly significant difference in the ability of 0.5 % cetylpyridinium chloride to control the pathogen as compared to other chemicals tested. The use of antimicrobial and surfactant chemical sprays for pre-chiller chicken carcasses could be an important aid to decrease the number of foodborne illnesses attributed to poultry consumption.

32. Characterization of Putative IP3 Signal Terminating Enzymes from Arabidopsis thaliana

Ryan Burnette

The ability to respond to a variety of biotic and abiotic signals is crucial to many organisms. Signals outside the cell can be perceived and amplified at the cell membrane by a variety of signaling pathways, including the inositol 1,4,5-trisphosphate (IP3) pathway. In this pathway, activation of receptors stimulates the enzyme phospholipase C (PLC), which hydrolyzes phosphatidylinositol 4,5-bisphosphate (PIP2) forming 1,2-diacylglycerol (DAG) and IP3. As a second messenger, IP3 increases transiently, eliciting an intracellular Ca²⁺ release. This transient accumulation provides for discrete and regulated signaling, and may itself be regulated by signal terminating enzymes that hydrolyze IP3. In plants, there is evidence that common signals such as light, pathogens, and gravity are perceived via IP3 signaling. To determine whether the signal terminating enzymes that hydrolyze IP3 are regulatory in plants, we have identified fifteen putative inositol 5'-phosphatases (5PTases) in the model plant Arabidopsis thaliana. We have characterized the substrate specificity of one of these enzymes, At5PTase1. At5PTase1 can hydrolyze IP3 and IP4 but not PIP2 substrates. We have examined the expression of this gene and found that At5PTase1 is rapidly upregulated in response to light, cold, and the plant hormone ABA. Transgenic plants overexpressing At5PTase1 have been constructed and shown to contain elevated 5PTase enzyme levels. These plants are being investigated as to their physiological responses to determine if deregulation of IP3 can modulate physiology.

33. Mathematical Model of the Budding Yeast Cell Cycle

Laurence Calzone

The cell cycle of the budding yeast, *Saccharomyces cerevisiae*, is regulated by a complex network of chemical reactions controlling the activity of a cyclin-dependent kinase (Cdk), a protein kinase that drives the major events of the cell cycle. A previous mathematical model by Chen et al. (2000) described a molecular mechanism for the "Start" transition (passage from G1 phase to S/M phase) in the budding yeast cell cycle. In this poster, our main goal is to extend Chen's model to include new information about the mechanism controlling "Finish" (passage from S/M phase to G1 phase). Our mechanism includes all the major players involved in bringing budding yeast cells from metaphase to G1: cyclin-degradation proteins (Cdc20 and Cdh1), a CDK inhibitor (Sic1), an essential protein phosphatase (Cdc14), binding proteins (Pds1 and Net1), a protease (Esp1), and signal transduction proteins (Cdc15, Mad2 and Bub2). Using laws of biochemical kinetics, we transcribe the hypothetical molecular mechanism into a set of differential equations. Our simulations of the wild-type cell cycle and the phenotypes of more than 60 mutants defective in exit from mitosis provide a thorough understanding of how budding yeast cells exit mitosis.

34. Inhibition of XChk1 Induces a Maternal Program of Apoptosis at the MBT in Xenopus Embryos

Ayesha Carter

Xenopus laevis embryos provide a rare example of nonpathological unregulated cell divisions. Following fertilization, embryos undergo a period of rapid divisions, alternating between S (synthesis) and M (mitosis) phases, until the twelfth division. The twelfth division marks a point known as the midblastula transition (MBT) where a critical nuclear to cytoplasm ratio triggers cell cycle lengthening and embryonic transcription. Embryos treated prior to the MBT with ionizing radiation (IR; to damage DNA) or aphidicolin (to block DNA replication) die before gastrulation from a developmentally regulated program of apoptosis. This apoptotic response may be initiated whenever embryos are unable to support synthesis of new proteins at the MBT and are fated to become non-viable by gastrulation. After the MBT, embryos treated with IR and aphidicolin are more resistant to apoptosis, suggesting an alternative pathway of cell cycle arrest and repair. XChk1 is a serine kinase that mediates cell cycle arrest by inhibiting Cdc2 and Cdk2 in *Xenopus* embryos. Experiments were performed to investigate the relationship between XChk1 signaling and apoptosis. Embryos were injected with mRNA encoding dominant-negative, catalytically inactive XChk1 (NA135XChk1) at the one-cell stage. Control embryos were injected with equal amounts of luciferase mRNA. Embryos expressing (NA135XChk1) exhibited dramatic bursting cell death during gastrulation. Staining by TUNEL assay indicates that this death is apoptotic in nature. These experiments support the hypothesis that XChk1 normally blocks apoptosis after the MBT in *Xenopus* embryos, possibly by inhibiting Cyclin A1/Cdk2. Therefore, XChk1 may function as a molecular switch to determine whether a cell will enter a cell cycle checkpoint (XChk1 on, Cdk2 off) or a program of apoptosis (XChk1 off, Cdk2 on).

35. Homology Modeling of the *tt4* Alleles in *Arabidopsis*

Christopher Dana

Chalcone synthase (CHS) catalyzes the first committed step in flavonoid biosynthesis, a major pathway of plant secondary metabolism. An allelic series for the *Arabidopsis* CHS locus, *tt4*, has recently been characterized at the gene, protein, and endproduct levels (Saslowky, et al., 2000). The mutations identified in each of these alleles were also located on a homology model of the wild type *Arabidopsis* CHS protein, which is based on the crystal structure of CHS from *Medicago sativa* (Ferrer, et al., 1999). We have extended this analysis, refining the original model and generating structures for the mutant proteins. These structures are being used to analyze the effects of the mutations on protein folding and how this impacts function. The *tt4*(UV113) allele contains a threonine to proline mutation at position 174, in an alpha helix adjacent to the active site, that appears to completely disrupt enzymatic activity without affecting the stability of the protein or its ability to form homodimers. The *tt4*(38G1R) mutation is a 5 bp deletion that results in the insertion of a stop codon at position 384 and truncates the protein by 12 residues. This mutation also completely disrupts enzyme activity, but in addition reduces the stability of the protein. Interestingly, the structures of two temperature sensitive alleles, *tt4*(UV01) and *tt4*(UV25), appear to contain significant conformational differences when modeled at different temperatures. These computational approaches are providing new insights into how residues outside the CHS active site may impact enzyme activity, function, and stability.

36. The effects of fatiguing stimulation of rat skeletal muscle on glycogen, glycogen phosphorylase, and calcium uptake associated with the sarcoplasmic reticulum

Simon Lees

Both glycogen and glycogen phosphorylase (GP) are associated with skeletal muscle sarcoplasmic reticulum (SR) membranes. This investigation sought to determine if fatiguing activity alters the amount of glycogen and GP associated with the SR. Tetanic contractions (75 Hz, 100ms) were evoked in situ in rat gastrocnemius muscles for 15 minutes which resulted in a 70-80% decrease in tetanic force. Immediately after stimulation, muscles were removed, homogenized and SR vesicles prepared. Stimulation reduced muscle glycogen content by 77% (43.42 ± 1.73 vs 9.96 ± 1.23 mmol/kg wet mass, $p < .05$) whereas glycogen associated with the SR was reduced by a greater extent, 95% (415.39 ± 76.62 vs 21.36 ± 2.07 ug/mg SR protein, $p < .05$). SDS-PAGE revealed that GP was decreased by 79% in our fatigued samples despite no change in the amount of Ca^{2+} ATPase present. Pyridoxyl 5' phosphate (PLP), a quantitative measure of GP, was measured via HPLC. Stimulation lowered PLP content by 97% (251.77 ± 47.68 vs 8.35 ± 2.30 ng/mg SR protein) and reduced GP activity by a similar extent (2.80 ± 0.16 vs 0.12 ± 0.02 nmol G-1-P/mg SR protein per min.). These results suggest that both glycogen and GP associated with the SR are reduced during fatigue. Supported by NIH AR 41727.

37. Dysregulation of CD40L Expression Contributes to Tumor-induced Macrophage Dysfunction

Ryan S. Martins* and Klaus D. Elgert

Tumors evade immune responses, in part, through the release of suppressor signals that dysregulate host effector cell function. In this study, we demonstrate that tumor growth suppresses immune activation by inhibiting T cell CD40 ligand (L) expression. Decreased CD40L expression disrupted macrophage activation pathways, leading to impaired production of immunostimulatory mediators, interleukin (IL)-12 and IL-18 by tumor-bearing host (TBH) macrophages. IL-12 and IL-18 production by normal macrophages is also lowered upon incubation with tumor-derived supernatants, demonstrating the role of tumor-derived factors. Disruption of CD40L expression, via dysregulation of IL-12 and IL-18 production, impedes T cell interferon (IFN)-gamma, which in turn exacerbates macrophage dysfunction. IFN-gamma is essential for expression of interferon consensus sequence binding protein (ICSBP); TBH macrophages demonstrated lowered expression of ICSBP, which participates in the regulation of CD40L, IL-12 and IL-18 expression through the interferon-stimulated response element (ISRE). Thus, dysregulated CD40L expression significantly contributes to tumor-induced immune dysfunction.

38. Litterfall production in forested wetlands with contrasting hydrologic regimes

Matthew Neatrou

We examined annual litterfall production in two major types (riparian and depressional) of seasonally-inundated forested wetlands in the Gulf Coastal Plain. Riparian wetlands are periodically inundated by river flooding, which supplies nutrient subsidies, whereas depressional wetlands receive water and nutrients via precipitation. Mean litterfall production was greater in riparian wetlands (625 g m²y⁻¹) than in depressional wetlands (460 g m² y⁻¹), although the difference was not significant. This was due to one highly productive depressional wetland (626 g m² y⁻¹). *Taxodium* spp. were the dominant contributors to litterfall in both types of wetlands, but litter inputs of *Nyssa sylvatica* var. *biflora* were also substantial in depressional wetlands. Litter nitrogen (N) and phosphorus (P) inputs were higher ($p < 0.01$), and nutrient use efficiency (NUE) of N and P was lower ($p < 0.01$) in riparian wetlands than in depressional wetlands. Both wetland types were P-limited as indicated by high N/P ratios and temporal patterns in litter P concentrations. These results suggest that different hydrologic regimes influence litterfall production and P NUE in wetlands of the Gulf Coastal Plain. However, the relationship between litterfall production or NUE, and the timing and/or length of the hydroperiod is complex. Studies are in progress to determine the underlying factors that cause litterfall variability.

39. Mixtures of Pesticides Potentiates the Immunotoxic Risks. Selen Olgun*, Hara P. Misra
Selen Olgun*, Hara P. Misra

Multiple exposures to mixtures of classes of pesticide are possible because of widespread use. Exposure to pesticide mixtures can result in adverse health effects, mainly because one can affect the metabolism of other. Immune system is a target for toxicity for different classes of pesticides. We examined the immunotoxic potential of concurrent exposure of lindane (organochlorine) and malathion (organophosphate) to murine (C57Bl/6) thymocytes in culture. A flow cytometric (7-aminoactinomycin D) assay was used to distinguish live, early apoptotic and late apoptotic/necrotic populations. A dose-dependent response was obtained by exposing to individual pesticides. For mixture studies, concentrations of pesticides were chosen that would result in minimum cell death. The early apoptotic cell death, as determined by this assay, for solvent control (0.6% EtOH), lindane (50 μ M), malathion (75 μ M) and pesticide mixture (50 μ M lindane + 75 μ M malathion) were found to be 10.6 ± 1.4 , 11.74 ± 0.9 , 15.3 ± 1.8 and 32.1 ± 2.1 , respectively. The results of DNA ladder assay and Annexin V assay concur the apoptosis of thymocytes exposed to these chemicals at these low doses. Cells exposed to pesticide mixtures resulted in a very intense DNA laddering with little genomic DNA remaining in the cells. The necrotic cell death, as determined by LDH release assay, for solvent control (0.6% EtOH), lindane (50 μ M), malathion (75 μ M) and pesticide mixture (50 μ M lindane + 75 μ M malathion) were found to be 7.3 ± 0.7 , 19.8 ± 1.0 , 24.6 ± 2.5 and 60.9 ± 3.5 , respectively. These results indicate that thymocytes undergo both apoptosis and necrosis when exposed to low doses of individual pesticides and exhibit a significant ($p \leq .05$) synergistic effect with mixtures of pesticides.

40. EFFECTS OF ACTIVATED CALCINEURIN ON MYOSIN HEAVY CHAIN (MHC), TROPONIN I (TnI), AND SARCOPLASMIC RETICULUM Ca^{2+} ATPase (SR-ATPase) ISOFORMS EXPRESSION.

Jeffrey Otis

Calcineurin has been suggested as a mediator of activity-induced changes in muscle phenotypic expression. For example, transgenic mice expressing constitutively active calcineurin display higher numbers of slow fibers (as determined by myofibrillar ATPase staining) than control mice. However, adaptations to proteins of the actin-based thin filament and SR were previously unknown. Based on immunohistochemical analysis, we measured the isoform compositions of TnI and SR-ATPase of MHC-based fiber types in the plantaris muscle of 3-month old female B6C3F1 mice expressing an MCK-CN transgene. The MCK-CN transgene consisted of 4800-bp of the muscle creatine kinase enhancer and the full-length coding sequence of the activated form of calcineurin followed by the human growth hormone polyadenylation signal ($n = 4$). Age-matched, female wild-type littermates served as controls ($n = 4$). The plantaris displayed significant shifts toward fibers with slower MHC, TnI and SR-ATPase isoforms. Wild type plantaris contained on average 6% slow and 94% fibers with fast isoforms, whereas MCK-CN mouse plantaris contained on average 31% slow and 69% fibers with fast isoforms. Interestingly, protein isoform compositions of MHC, TnI and SR-ATPase, regardless of group, were coordinated, such that, a given fiber would only express a full complement of fast or a full complement of slow isoforms. These data are consistent with a role for calcineurin in mediating coordinated "fast-to-slow" adaptations in muscle phenotype.

41. Xenopus Chk1 (XChk1) alters the cell cycle remodeling at the MBT

Matthew Petrus

In the early cell divisions of *Xenopus laevis* embryos, cells divide with little regulation. At the midblastula transition (MBT), the cell cycle is remodeled as the division time is extended, checkpoint controls are acquired, and in response to damaged and unreplicated DNA the protein kinase XChk1 becomes activated and prevents progression into mitosis. Degradation of cyclin E has been linked to a maternal timer that determines the initiation of the MBT. We tested the effect of altered XChk1 expression on the timing of the MBT in *Xenopus* embryos. One-cell stage embryos were injected with mRNA encoding XChk1 or luciferase, as a control. XChk1 elevates the levels of cyclins A1 and B1, consistent with cell cycle arrest in mitosis and delays the disappearance of cyclin E at the MBT and cyclin A1 at gastrulation. Since we have previously demonstrated that XChk1 inhibits cyclin E/Cdk2 activity, we hypothesize that XChk1 may play a role in altering this timer at the MBT. The mitotic inhibitor Wee1 is also normally degraded at gastrulation, but in the presence of exogenous XChk1 it remains stable, and increases after the MBT. These results further suggest a role for XChk1 in cell cycle remodeling at the MBT.

42. Adding 3-D information in forest remote sensing

Sorin Popescu

Airborne lidar technology is able to provide information on ground topography and vegetation canopy surface. Processing algorithms can extract a high-resolution digital terrain model (DTM) and various measurements of the forest vegetation. This paper presents processing algorithms for deriving the terrain model, interpolating techniques of raw lidar points into regular grids, and estimating tree heights and stand density by using a multiple return, high-density, small-footprint lidar data set acquired in the Piedmont physiographic province of Virginia, USA. The ground-truth plot design followed the U.S. National Forest Inventory and Analysis (FIA) field data layout. Two lidar processing algorithms are discussed - one based on single tree crown identification and the other based on the height of all laser pulses within the area covered by circular FIA plots. Linear regression was used to develop equations relating lidar-estimated parameters with field inventories for each of the FIA plots. As expected, both algorithms predicted the maximum height on each plot with the highest accuracy (R2 values of 86% and 90%). The algorithm based on individual tree crown location performed better for predicting heights of dominant and co-dominant trees (R2 values above 82%). The number of trees can only be estimated using the individual tree crown algorithm, with an R2 value of 62%. The terrain DEM lacks a field based estimation of its accuracy, but judging by the results obtained for tree heights, it is assumed to model fairly accurately the terrain topography.

43. Expression of adeno-associated virus rep gene in Arabidopsis thaliana

Daniel Sisco

Advances in genetic engineering technologies have allowed for improved agricultural productivity and a greater understanding of the molecular basis of fundamental plant processes. However, current plant transformation strategies result in highly variable transgene expression levels. We are developing a novel adeno-associated virus (AAV) based system for generating transgenic plants. AAV is a mammalian parvovirus that, without co-infection of a helper virus (adenovirus), selectively integrates into a specific region on human chromosome 19. AAV-based vectors are commonly used in human gene therapy trials because the AAV genome integrates site-specifically and infection causes no disease symptoms. Rep is a virally encoded enzyme that recognizes the AAV inverted terminal repeats (ITRs) and mediates AAV genome integration into the chromosome 19 sequence, known as AAVS1. rep was amplified, cloned into pRTL2, and subcloned into pBIB-HYG for introduction into and expression in *Arabidopsis thaliana*.

44. ITS Phylogeny of Iliamna (Malvaceae)

Tracey Slotta and Duncan Porter

The genus *Iliamna* (Malvaceae) consists of eight species distributed across temperate North America. Two species, *I. corei* and *I. remota*, are found east of the Mississippi River and the remaining species are in the Rocky Mountains and west. Ira Wiggins described seven species in a monograph of *Iliamna* in 1936. Since that time, no systematic work has been conducted on the genus. Most species were previously placed into the genus *Phymosia* and/or *Sphaeralcea*. Separation of *Iliamna* from *Sphaeralcea* and *Phymosia* by Wiggins was based upon morphology of carpels, leaves, and flowers, as well as differences in chromosome number and habitat. Recently, the need for systematic study became apparent after *I. corei* was listed as a federal endangered species (1994) and its relationship to *I. remota* questioned. Sequences from the internal transcribed spacer (ITS) of the nuclear ribosomal DNA (nrDNA) are being used to develop a phylogeny determining the biogeographical and evolutionary history of the genus. Phylogenetic analysis using parsimony was performed and the resulting phylogeny of the genus is presented. The genus does appear to be monophyletic with three main clades being formed. One contains the the Pacific Northwest species, another with all of the remaining species and the third clade is nested therein and consists of the two Eastern species. The ITS data does provide information bringing new insight to the origination of the genus and its distribution.

45. Estimating Rate Constants in Cell Cycle Models

Jason Zwolak

Cell cycle models used in biology can be very complex. These models have parameters which affect the accuracy of the model both quantitatively and qualitatively. Finding the values for parameters is typically done by guessing and checking; using the computer only to check the results of the model with a given set of parameters. This poster will describe methods and results using the computer to do the checking and the guessing. The program described is based on ODRPACK (used for estimating parameters) and LSODAR (used for solving systems of ODEs in the model). The program requires an initial guess for the parameters and experimental data related to the model. The experimental data are not always directly related to the model. Therefore, code must be written to evaluate a function of the model that yields data comparable to the experimental data.

Physical Sciences

46. QUANTITATIVE ESTIMATES OF TIME-AVERAGING IN ARTICULATE BRACHIOPOD ACCUMULATIONS FROM A HOLOCENE TROPICAL SHELF (SOUTHERN BRAZIL)

Monica Carroll, M. Kowalewski, M. Simoes, and G. Gooffriend

Modern representatives of articulate brachiopods, predominant in tropical marine environments of the Paleozoic Era, have previously been studied only at higher latitudes in cold water settings. This study presents data on the temporal resolution within tropical brachiopod accumulations off the coast of Brazil. 80 specimens from 4 localities were analyzed for amino acids, by HPLC. The ratio of alloisoleucine to isoleucine (A/I) of individual shells was calibrated with radiocarbon dates of 5 specimens yielding a strong correlation ($r^2=0.91$), showing that A/I ratio is an excellent predictor of radiocarbon age. Previous racemization dating has focused on mollusks. This is the first study to demonstrate that racemization rates can be effectively applied to the analysis of brachiopods. We find that brachiopods show similar patterns of temporal resolution to mollusks. Age distributions are right skewed, the scale of temporal mixing is comparable (~1000 years) and studies of both organisms suggest significant variation in population through time. The study also shows that, like mollusks, brachiopod shells survive for hundreds of years. This contradicts accepted wisdom that brachiopods will not preserve as well as mollusks. These results indicate that articulate brachiopods can be precisely dated provide a relatively continuous geochemical record for the last 1000 years.

47. Understanding the Molecular-Scale Processes of Mineralization: The Role of Mg²⁺ in Calcite Growth

Kevin Davis

As mineral formation becomes increasingly important to the expanding fields of biomineralization, geomicrobiology, and paleoclimatology, it is essential to determine the physical and chemical factors controlling mineralization. Further advancement in these areas requires a fundamental understanding of the individual molecular-scale processes responsible for crystallization. Microscopic observations are often able to provide crucial information concerning growth mechanism and morphology that is otherwise unobtainable through macroscopic techniques. Here we use in situ fluid-cell atomic force microscopy (AFM) to achieve a physical understanding of the role of Mg²⁺ in governing calcite formation. Despite the biogeochemical importance of this system, macroscopic studies have failed to discern the actual mechanism by which Mg²⁺ mediates calcite growth and morphology. AFM was used to resolve the controversial mechanism of calcite inhibition by magnesium through molecular-scale determination of the thermodynamic and kinetic controls of Mg²⁺ on calcite morphology and growth. Comparison of directly observed monomolecular step velocities to standard impurity models demonstrated that calcite growth inhibition was due to enhanced mineral solubility through Mg²⁺ incorporation. Terrace width measurements on calcite growth spirals showed that step-edge energies were unaffected by Mg²⁺ incorporation. Ca_{1-x}Mg_xCO₃ solubilities determined from microscopic observations of step dynamics can thus be linked to macroscopic

measurements. Finally, a microscopic model for some macroscopic calcite morphologies observed in the presence of Mg^{2+} is presented.

48. Anisotropic 2D Transient Heat Conduction Model for Lumber Drying

Hongmei Gu

Wood is a strong anisotropic material due to its structure. So when wood is subjected to drying conditions, it shrinks anisotropically. Significant differences between the radial and tangential shrinkage have been found for years and recognized as the main factors for drying defects. Significant differential shrinkage is coming from the different heat and mass transfer rate in the two directions during the drying. Heat and mass transfer coefficients, such as thermal conductivity and diffusivity, play dominant roles during the drying process. Transport coefficients of wood are very structure dependent and sensitive to the environment. This research is trying to derive thermal conductivity in the radial and tangential direction from the wood anatomical structure model and thermal resistance model proposed in this study. Wood anatomical structure characteristics related to heat transfer coefficients are examined under SEM (Scanning Electron Microscopy). The ratio of derived thermal conductivity in radial over tangential is about 2.7:1, with the values of 0.128W/m \times K for the radial thermal conductivity and 0.047 for the tangential thermal conductivity. A mathematical model of anisotropic 2D transient heat conduction is solved in Mathematica Software with Finite Difference Method using the derived values of thermal conductivity. Output from the model is used to examine anisotropic material property effects on the drying quality control. Animated heat transfer processes for lumber drying are shown in the Mathematica Environment. Mathematica Software is used for the scientific research in engineering analysis and modeling because of its powerful numerical solving technique and plotting options for the best visualization.

49. A NEW DINOSAUR BONEBED IN THE MORRISON FORMATION OF BIGHORN COUNTY, WYOMING

Brooke Wilborn

The Morrison Formation northwest of Shell, Wyoming is well known for its vertebrate fossils. The famous Howe Quarry, first worked by Barnum Brown in the 1930s has produced a plethora of spectacular Jurassic dinosaurs, including Barosaurus, Diplodocus, Apatosaurus, and Camarasaurus. Recent excavation of a large bonebed approximately one mile west of the Howe Quarry has revealed disassociated elements of diplodocids and stegosaurus. Geographic Information Systems technology is being used to assist in the analysis and integration of the data from the bonebed. Photogrammetric images of the site are captured to record the skeletal material as it is uncovered and before it is removed from its contextual setting. This provides a visual and spatial record of the location and relationships of skeletal material. It also preserves a visual record of related matrix textures and features and provides a 3-dimensional framework to record the location of samples taken away for analysis. This data is being integrated into a real world rectangular coordinate system that will ultimately allow us to build a 3-D model of the skeletal material found at the site. This state-of-the-art documentation technology will assist us in the taphonomic interpretation of this fascinating locality.

Social Sciences and Humanities

50. The Effect of Carpet Fiber on the Growth of Dermatophagoides farinae in a Controlled Environment

Glenda Andes

Mites are endemic and allergy to mite excreta and parts is one of the most common allergies. Health care practitioners have recommended the removal of carpets from homes of people with mite allergies. Little, if any, consideration is given to the fact that some persons may benefit directly from the presence of carpet in their homes. In the allergen and mite research literature carpets are rarely described as having unique characteristics and are generally referred to as a generic entity. Carpets, however, do have unique characteristics. Seventy-two pieces of commercially available, residential flooring materials were inoculated with identical numbers of mites and placed in the Textiles Conditioning Lab. The mites and carpet pieces were maintained in the lab, under identical, environmentally controlled conditions for 6 weeks, then mites were extracted and counted. On the basis of the results of statistical tests run on the study data, the null hypothesis, that there is no difference between the numbers of mites grown on the different flooring conditions, was rejected. Statistically significant differences exist between the hard floor and nylon carpet, between hard floor and olefin carpet, but no difference between hard floor and wool carpet. Nylon was the carpet fiber that was most supportive of the growth of house dust mites, olefin was the second most supportive and wool carpet and hard floor were similar in being the least supportive.

51. The Effect of Coping on the Relationship Between Child Behavior Problems and Exposure to Community Violence in School Children

Felicia Bowser

This study examines effects of community violence exposure on antisocial behavior problems and the moderating effect of coping. Seventy-eight ninth grade male and female students from a predominantly rural setting were recruited and grouped according levels of self-reported community violence exposure and active and avoidant coping strategies. It was hypothesized that 1) adolescents with high levels of violence exposure would exhibit greater school misbehavior problems than those with low levels of exposure; 2) adolescents with high levels of active coping would exhibit fewer school misbehavior problems, and those with high levels of avoidant coping would exhibit greater school misbehavior problems; 3) adolescents with high levels of violence exposure and high levels of avoidant coping and low levels of active coping would exhibit the greatest level of school misbehavior problems. Fifty-five percent reported being a victim of community violence and 86% reported witnessing community violence. A significant interaction indicated that individuals with low levels of both active and avoidant coping exhibited more school infractions as well as more severe and aggressive types of infractions. For severity and aggressiveness, this interaction effect of coping on school misbehavior was strongest only in individuals with higher levels of community violence exposure.

52. Financial Liberalization, Competition, and Sound Banking

Xiaofen Chen

Previous studies seem to agree that financial liberalization contributed to financial instability by promoting riskier banking behavior through intensified competition. This research shows that this consensus is questionable. By constructing two models of lending relationship with credit risk and market risk, it demonstrates that financial liberalization -- removing entry restrictions specifically -- may increase banks' incentives to screen loan applicants. It may also reduce excessive reliance on collateralized loans, and thus a more competitive banking system can be less vulnerable to asset price shocks. A key difference from previous studies is that it takes into account the interactions of a bank's loan rate decision and its screening activities. A monopoly bank's market power regarding the loan rate limits the effect of screening activities on its loan rate decision. When a bank faces competition, screening has the additional effect of reducing the pressure of cutting loan rates in order to compete for high quality applicants. Thus, the marginal benefit of screening increases when there is competition. As a result, removing entry restrictions increases banks' incentive for screening and promotes safer banking.

53. A Comparison of Two Vagally Mediated Heart Period Variability Measures

Israel Christie

Parasympathetic (i.e., vagal) control of the heart has been related to a number of psychological variables such as attention and emotion. Measures of heart period variability (HPV) are commonly used as noninvasive indexes of cardiac vagal control. Two such measures are the root mean square of successive differences in heart period (MSSD) and peak-to-trough measured respiratory sinus arrhythmia (RSA), although the latter is generally held to be a more sensitive and reliable index and the usefulness of the former has been questioned. The present study assessed the utility of these measures in distinguishing between tasks characterized by cardiac vagal (quiet sitting, supine rest, slow paced breathing) and mixed sympathovagal (facial cooling during video game) activity from a task characterized by sympathetic activity (isometric handgrip). Six college-aged females participated in each task on three separate occasions while MSSD and RSA were derived from electrocardiogram and impedance cardiogram; measures were averaged across sessions. Analysis showed both MSSD and RSA were greater in each vagal task compared to handgrip. The sympathovagal task showed greater RSA but not MSSD compared to hand grip. Results suggest RSA is more sensitive during sympathetic-parasympathetic coactivation, but MSSD has equivalent utility in distinguishing strongly vagal and sympathetic tasks.

54. Effects of A Stressor Task On Cardiovascular Activity, Attributions and Affective Responses of High MGRS Men to Provocative Partner Behavior

Keryl Cosenzo

Men who strongly adhere to a masculinity ideology are more likely to experience stress in situations that they appraise as threatening to their enacting their masculine gender role imperatives. The Male Gender Roles Stress (MGRS) is used to identify such men. High MGRS men report more negative attributions and negative affect toward a female whose behavior challenges, criticizes or rebukes her partner. However, the relationship between affect and attributions is unclear because measures of attributions and affect are obtained after the presentation of the provoking situation. Thus the present study investigated the effects of a stressor task on the cardiovascular reactivity, attributions and affective responses of high and low MGRS men to vignettes depicting provocative or non-provocative behavior by a female toward her male partner. High and low MGRS men performed a serial subtraction task (by 7's or 1's). After each task, vignettes depicting non-provocative or provocative partner behavior were presented and attributions measured. Cardiovascular activity and negative affect were greater for subtraction by 7's than 1's. Cardiovascular activity declined from the task to the vignette; the decline was less for high MGRS men. High MGRS men reported more negative attributions and negative affect to vignettes than low MGRS men.

55. The Relationship Between Magnitude of Cortical Activation and Cardiovascular Responding

Paul Foster

Research has indicated that whereas the left temporal lobe is associated with parasympathetic control of cardiovascular functioning the right temporal lobe is associated with sympathetic control. However, although research has delineated the cerebral areas involved in cardiovascular functioning, a greater understanding of exactly how changes in the activation of these cerebral areas produces specific changes in cardiovascular responding has yet to be investigated. The present study sought to determine whether a relationship existed between the magnitude of cerebral activation and changes in heart rate and systolic and diastolic blood pressure. It was hypothesized that increasing activation of the right temporal lobe would be associated with increases in heart rate and systolic and diastolic blood pressure. A total of sixteen female undergraduates participated in this investigation. Following the establishment of baseline electrocortical and psychophysiological recordings the participants were instructed to recollect an event to which they responded with anger for 45 seconds. The magnitude of cerebral activation within the alpha bandwidth and changes in psychophysiology were averaged across this 45 second exposure time. Correlational analyses indicated that significant positive correlations existed between changes in all psychophysiological measures and changes in electrocortical activity in the temporal lobes and surrounding areas.

56. Assessing the Factors Impacting High School Violence

Anthony Jenkins

From 1996 to 1997, more than 8,173 incidents of high school violence have occurred in the 119 public schools in the North Carolina system. Statewide, sixty-four percent of urban principals said violence has increased in their schools in the past five years; as did fifty-four percent of suburban principals and forty-three percent of those in rural areas. Social Control Theory and Routine Activity Theory were utilized to examine the effects of six independent variables (attachment, school environment, personal safety, drug use, gender and age) on the dependent variable of high school violence. A questionnaire was created and administered to a sample (N=150) of students attending a Durham County high school.

57. Organizational Attributes as Correlates of Nonprofit Financial Performance

Gary Kirk

Pressure from funding sources and increased emphasis on accountability have led the nonprofit sector to emulate for-profit sector organizations. In recent years, this has prompted a new focus on strategic improvement or maintenance of financial viability. The objective of this study was to determine whether selected organizational attributes are related to nonprofit financial performance. Using data from the National Center for Charitable Statistics, this study investigated three organizational attributes (vertical differentiation, age, and size) as correlates of nonprofit financial performance in three nonprofit subsectors: higher education, health, and community. An indirect measure of vertical differentiation proved to be significantly correlated ($p < 0.05$) with overall financial health, but not with financial growth. Age was positively correlated ($p < 0.001$) with revenue growth, but not with financial health. Size, as measured by discretionary resources, was found to be insignificant in predicting either financial health or growth. An inclusive model, controlling for subsector, revealed that the selected organizational attributes together could account for a relatively small portion of variance in each of the financial performance indicators. Only revenue growth was significantly predicted ($p < 0.001$) by the overall model. Due to the large sample size ($n=7,048$), statistical significance was not an adequate test of theoretical or practical significance.

58. A Study of Preference for Traditional and Modern Shopping Environments in Bangkok, Thailand: Preliminary Results

Apichoke Lekagul

Traditional shopping environments have long been a major part of Thai culture, providing people the economic, social, and psychological needs. Nowadays, the prospering western-style shopping environments render their characteristics less preferred and their services limited. To preserve this cultural heritage, this research is purposed to: 1) identify environmental factors influencing preferences of Thai shoppers for different shopping environments, and the relationships with their shopping habits, and backgrounds; 2) provide design recommendations for traditional shopping environments to enable them to survive in the new economy. Factor analysis of preference data was used to identify important underlying environmental factors. Behavioral and demographic data were analyzed using MANOVA to identify further relationships between different types of shoppers and environmental factors. The results show perceived differences between different characteristics of shopping environments and that these differences relate to

opportunities for social and recreation activities as well as shopper needs. These differences are related to the time of day that people shop, the length of shopping visit, the shoppers' age and level of education, and family shopping habits. The physical characteristics of traditional shopping environments could be enhanced by improving perceptions of environmental qualities, comfort, involvement, and opportunities for recreation and social interaction.

59. Referral Networks and Job Mobility

Erika McEntarfer

A neglected issue in the social networks literature is the effect of referral networks on job mobility. When there is asymmetric information in labor markets, job mobility is constrained by adverse selection in the market for experienced workers. However, if workers can acquire references through their social networks then they can move more easily between jobs. In this paper we develop a simple labor market model in which workers can learn the productivity of other workers through social interaction. We show that networks increase wages and mobility of high-productivity experienced workers; however, networks discourage workers from accepting jobs outside their job-contact network, because of adverse selection. We also that decreased dependence on network information results in increased mobility for workers with testable skills.

60. A social-behavioral study of urban plazas in Maracaibo-Venezuela, Case Studies: Plaza de la Madre and Plaza de la Republica

Monica Montero

Plaza de la Madre and Plaza de la Republica are two important urban settings in Maracaibo-Venezuela that were studied from a social behavioral perspective in order to understand people's behavior and preferences in public spaces. The study arises as a need to reconsider human factors in urban landscape design which has been left behind by many designers in Maracaibo-Venezuela. Similar studies in the US have shown that public spaces better suit people's needs when social analysis and research have been developed in urban design. The research is qualitative-exploratory in which behavioral settings and observation and tape-recorded interviews were developed in order to obtain information from different urban actors. Users interviews were applied randomly at different hours of the day and to different age-group individuals. The study showed urban space successful and non-successful qualities that will be used as a basis for creating general urban social-behavioral design guidelines. Users considered the general social-physical environment the most satisfying issue for both plazas. Surveillance, being accompanied by others and feeling safe was very important. The highest use intensity was experienced during morning and evening hours when microclimatic conditions were cooler. The opportunity to exercise, bring kids to play, meet and gather with family and friends, good maintenance, the presence of green spaces and trees were some other important people's preferences. Interviews reported Plaza de la Republica the most successful environment with higher people's satisfaction levels. In general, environments that strongly fulfils human needs are highly visited by people. The study arises the need to develop more research on this subject a way to avoid presupposing people's needs in design and creating more assertive and people oriented public spaces.

61. Satisficing, Maximization and Rationality: Towards a Transactional Theory of Behavioral Decision Making

Shabnam Mousavi

I investigate current issues in decision theory in light of debates in the philosophy of science on the nature of knowledge, inquiry, and rationality. John Dewey's transactional view basically regards behavior as no different from inquiry per se. There is a definite link between Simon's view of decision-making and Dewey's view of behavior qua inquiry. This research investigates how Dewey's theory can inform current issues in decision theory. One major issue is how to model purposeful behavior characterized by the pursuit of goals rather than maximization. One implication is how to develop an index of "persistence," which is one aspect of purposeful behavior. To this end, I am developing an index which is the proportion of adjusting the behavioral alternatives (that the agent considers) to the adjustment of aspiration level inspired by Herb Simon (*Models of Man*, Ch13). I managed to find a philosophical counterpart in Dewey's work. Namely, Dewey defines "successful functioning" as when the organism adapts itself either "passively" to an existing environment to meet its needs and desires, or "actively" to transform the environment (*Middle Works of John Dewey* 6: pp. 364-365). Putting the notions together, the passive organism is less persistent than the active one. This index would be relevant to psychology as well. Another implication would be the conceptual equivalence of Simon's rejection of "global rationality" and Dewey's denial of the existence of any fixed and final law. I will use what I have learned from Dewey and combine it with Simon's behavioral economics. Given that inquiry is a behavior, we will extend Dewey's transaction view to shed light on behavior in general, and decision under uncertainty in particular. We know that there is a current intense interest in decision under uncertainty and what is called "behavioral finance" that is challenging the standard model. There are about two dozen theories that seek to replace the standard, von Neumann-Morgenstern expected utility theory. I review the current models of bounded rationality from the standpoint of Dewey's. Then I develop a transactional view in words as well as formally. I hope to convince fellow economists about the relevance of the synthesized Simon-Dewey approach. Finally I will introduce a new view with formal predictive tools that shows us ways to investigate the problem of choice as it is.

62. Effects of Prenatal Sensory Stimulation on Behavioral Arousal in Bobwhite Quail Embryos.

Greg Reynolds

Although a number of studies have demonstrated the effects of prenatal experience on subsequent behavioral development, how these effects are achieved remains a topic of enduring interest. The present study examined the immediate effects of unimodal and bimodal prenatal sensory stimulation on behavioral arousal in bobwhite quail embryos. The top portion of the eggshell was removed on the 21st day of incubation and embryos were videotaped during a 12 min exposure period to (a) unimodal auditory stimulation, (b) unimodal visual stimulation, (c) concurrent audio/visual stimulation, or (d) no supplemental stimulation. Videotapes were analyzed to determine the amount of time embryos were active and the average duration of activity during stimulation and nonstimulation conditions. Results indicated that embryos' overall activity levels can be significantly affected by the type of prenatal sensory stimulation provided. Embryos receiving no supplemental stimulation or unimodal auditory stimulation showed relatively low levels of activity, whereas embryos receiving unimodal visual or bimodal audio/visual stimulation exhibited significantly higher levels of activity. Bobwhite embryos

appear to be particularly sensitive to unusually early visual stimulation and to concurrent bimodal stimulation, paralleling previous studies from our lab reporting that altered prenatal sensory stimulation can affect subsequent postnatal perceptual and behavioral responsiveness.

63. AUTONOMIC CHARACTERISTICS OF ANXIETY, DEPRESSION, AND CO-MORBID ANXIETY-DEPRESSION

Aimee Santucci

The affective styles of anxious and depressed individuals are detrimental to functioning because the ability to appropriately respond to environmental demands is compromised. The purpose of the present study was to clarify the relationship between negative affect and physiological activation in these conditions. Anxiety has been associated with reduced heart rate variability (HRV); however, findings of low HRV in depression have been mixed. A variety of cardiac measures were used to explore autonomic patterns in these disorders: HR, respiratory sinus arrhythmia (RSA, a HRV index of cardiac vagal control), and systolic time intervals from impedance cardiography. The Beck Depression Inventory and Beck Anxiety Inventory were used to select an anxious-only group (N=8), a depression-only group (N=5), an anxious-depressed group (N=14), and 17 control subjects from a large pool of female university students. All subjects did the following tasks: 5 minutes rest, a Stroop task stressor, and 5 minutes of recovery. One-tailed a priori contrasts revealed that the three emotion-disorder groups showed significantly less RSA (M=71.62) across tasks as compared to controls (M=99.01).

64. Exposure to Coping and Trauma in University Students

Elizabeth Van Voorhees

Previous research has suggested that there is a relationship between an avoidant coping and PTSD symptomatology in a variety of populations, including war veterans, motor vehicle accident survivors, and paramedics. The relationship between coping style and PTSD symptomatology was examined in a sample of 442 undergraduate students, with a specific focus on four styles of avoidant coping: mental disengagement, behavioral disengagement, denial, and substance abuse. Participants completed questionnaires on PTSD symptomatology and on coping styles. Results indicated that all four avoidant styles of coping were positively correlated with PTSD symptomatology, including re-experiencing, avoidance, and arousal symptom clusters, with p-values < .01. It is possible that avoidance of traumatic material through avoidance coping prevents the integration of traumatic material required for symptom reduction, and that interventions focusing on reducing avoidance coping may be indicated in individuals with PTSD.

Undergraduate students

65. Effect of HMG1 Overexpression on Isoprenoid Biosynthesis in Tobacco

R Athearn*, F Medina-Bolivar, and C Cramer

The plant isoprenoid pathway produces a vast array of metabolites including sterols and phytoalexins (metabolites involved in plant defense responses). The rate-limiting step of isoprenoid biosynthesis is catalyzed by the enzyme 3-hydroxy-3-methylglutaryl CoA Reductase (HMGR). This enzyme is encoded by a multigene family. The *hmg1* gene is associated with sterol biosynthesis whilst *hmg2* is associated with biosynthesis of phytoalexins. We propose that the HMG1 and HMG2 isoforms operate in two distinct metabolons synthesizing sterols and phytoalexins independent of each other. To test this hypothesis, a tomato *hmg1* cDNA was introduced into tobacco under the control of the constitutive 35S promoter. In the metabolon model, overexpression of HMG1 would lead to an increase in sterol production and have little or no effect on the production of phytoalexins. The *hmg1* cDNA also encoded for a 6His epitope tag for affinity purification and immuno-detection of the protein. PCR of genomic DNA from putative transgenic plants was used to screen for the transgene. Hairy root cultures will be made from plants containing the transgene. These hairy root cultures will be studied for the effects of HMG1 overexpression on the production of both sterols and phytoalexins. Exploring the mechanisms of pathway partitioning in plants can enhance our understanding of plant development and defense responses. By manipulating these pathways it may be possible to alter the levels of specialty plant metabolites, many of which have importance in the pharmaceutical and agricultural industry.

66. Isolation and Molecular Characterization of a Putative Plant ABC Transporter

Troy Hoff

ATP binding cassette (ABC) transporters are proteins that hydrolyze ATP to power movement of molecules across membranes, often against concentration gradients. Recently several genes encoding ATP-dependent export pumps have been cloned from plants and play a critical role in detoxification and defense against oxidative stress by sequestering a variety of cytotoxic compounds in vacuoles. We have identified a partial tomato cDNA (LEN14K6) encoding a putative ABC transporter from an EST (expressed sequence tags) database utilizing BLAST analysis with protein sequences derived from the well-characterized family of Arabidopsis ABC transporters. Sequence analysis of the 1 kb LEN14K6 clone (obtained from the Clemson Genomic Institute) encoded the 3' end including the poly-A tail. Rapid amplification of cDNA ends (RACE) using PCR and internal reverse primers resulted in 2 kbs of additional 5' DNA sequence. Southern analyses were used to determine the presence and complexity of the gene family. Tissue-specific gene expression in tomato plants was determined by RNA slot blots.

67. DNA Fingerprinting of *Orobanche minor* Populations in the US

Michael Johnnides

Orobanche minor is an exotic, invasive, parasitic weed that can cause severe losses in both quality and quantity of crop yield. *O. minor* is considered a noxious weed in the US and its import is prohibited. Nevertheless, infestations of *O. minor* have been discovered in such locations as Virginia, Georgia, and Oregon. This research is aimed at determining the relatedness of these infestations in an effort to identify their manner of spread. We are using the AFLP (amplified fragment length polymorphism) technique because of its power to reveal a large number of polymorphic fragments. AFLP uses two restriction endonucleases (EcoRI and MseI) to produce restriction fragments. These fragments then have adapters ligated to each end and only those fragments that have adapters will be successfully amplified. Successive rounds of PCR selectively amplify bands, which are separated by electrophoresis. Shifts and/or deletions in the banding patterns are used to identify similarities and/or differences between samples. This analysis revealed clear differences between *O. minor* and *O. aegyptiaca*. Although *O. minor* populations were similar, differences were identified between Oregon and Virginia populations. These results demonstrate the power of AFLP as a tool for understanding the dynamics of weed populations.

68. Tumor-induced Macrophage Dysfunction: Role of Interactions with T Lymphocytes

Ericka M. Neveu*, Melissa Maltempo and Klaus D. Elgert

As part of the immune response, macrophages and T lymphocytes play an important role in fighting tumors. However, in tumor-bearing hosts, tumors release suppressor factors, such as interleukin (IL)-10, transforming growth factor (TGF)- β 1 and prostaglandin (PG) E2 that inhibit macrophage activity. In normal hosts, CD40 from macrophages and CD40 ligand (L) from T lymphocytes interact to regulate macrophage activity. Tumor proliferation, however, inhibited T lymphocyte CD40L expression. This inhibited production of the immunostimulatory cytokine IL-18. IL-18 production in normal host macrophages is compromised when combined with tumor-derived supernatants as well, confirming the role played by the tumor. As a result of lowered IL-18 production, interferon gamma production in T lymphocytes is reduced. This results in lowered nitric oxide production and consequently impaired macrophage and T cell activation. Therefore, tumor growth inhibits CD40L expression and thereby alters the role of macrophages and T lymphocytes in the immune response.

69. Identification of Parasite-Inducible Genes in Arabidopsis

Christopher Viggiani

Orobanche is a parasitic weed that infects the roots of many important crop plants, draining water and minerals from its host. The host plant's response to such parasitism is being studied using a promoter trap strategy, which utilizes the GUS reporter gene that exhibits a characteristic blue phenotype when the gene is expressed. This project uses Arabidopsis lines containing promoterless GUS constructs randomly inserted in the genome. These lines were screened to identify those showing a blue color in the area of parasite attachment. The objective is now to identify Orobanche-induced genes into which the GUS gene has been inserted. A probe for the GUS sequence was used to determine lines containing a single insert and one of these lines was then chosen for sequence analysis. To identify sequences adjacent to the GUS tag, we used Inverse-PCR. This method cuts the GUS and associated Arabidopsis sequences from the genome and ligates it to itself to form a circular plasmid that was amplified by PCR. The amplified fragment was then sequenced to identify the tagged gene. By studying the function of genes induced during Orobanche parasitism we hope to understand the nature of the parasitism and develop effective control strategies.

70. Dietary Nickel Increases Bone Strength Characteristics of Layer Chicks

Edward Wilson and J.H. Wilson

The effects of dietary nickel (0, 25, 50, 75, 100, 150mg/kg) on performance parameters and bone strength characteristics of Bovan chicks were investigated. At 7 weeks of age, the shear force and stress of the radius from male birds increased when the diet was supplemented with 25 milligrams of dietary nickel per kilogram of feed (mg/kg). The shear stress of the tibia for the female birds also increased at 25 mg/kg dietary nickel. Dietary nickel had no effect on the bird body weight, but the male birds (595g) were heavier than the female birds (522g). All of the birds, regardless of diet, demonstrated the same parabolic weight gain relationship. Dietary nickel had no effect on the bone ash, or the calcium and phosphorus concentration of the tibia of the male birds. The ash content of the female birds decreased at 50, 75, and 100 mg/kg dietary nickel. Overall, the data indicates that adding 25 mg/kg dietary nickel to the Bovan diet will have a positive influence on bone strength characteristics.

Virtual

71. "Tennis Task Analysis" A model for improving teachers' visual observation skills

Ferman Konukman and E. Petrakis

Computer-Assisted Instruction (CAI) is a kind of tutorial implication in which a computer helps the learner(s) to present material and acts as a tutor. CAI implications include a specific subject in branching programs that direct learner's attention to different sections in a learning sequence without assistance of a teacher. Using Technology in physical education is gaining popularity recently. Technology can assist to provide more individualized instruction in the gymnasium or out of the gymnasium. Using Computer-Assisted Instruction (CAI) with multimedia technology students may learn motor skills and cognitive concepts. Tennis task Analysis is a problem-solving program that promotes the development of observatory skills of physical education students and teachers. It is designed to help learn the basic of tennis by using concept mapping, restructuring tasks, and video to identify either correct performance or common faults of each tennis skill. One of the advantages of these CD-ROM applications is that students may progress in their pace to learn main concepts. By using computer-assisted instruction, we hope to facilitate and improve instruction. Innovations in technology will contribute a better status of physical education in our schools in the millennium.

72. Nonequilibrium Phase Transitions in a Lattice Gas with Ising Interactions

Edward Lyman and B. Schmittmann

<http://quasar.phys.vt.edu/~lyman>

In an effort to understand systems far from equilibrium, simple models are studied in order to gain insight into macroscopic behavior, aiming toward an understanding of scaling and universality in non-equilibrium systems. As a first step in this direction, we present a monte carlo study of phase transitions in a lattice gas on a two dimensional periodic lattice, consisting of two oppositely "charged" particles, and holes. The positive (negative) particles are coupled to an external drive, which biases hops along (against) one particular direction of the lattice. Particles are coupled to one another with an attractive nearest neighbor interaction, are subject to an excluded volume constraint, and coupled to a thermal bath. At finite drive on a half-filled lattice, we find two disorder-order transitions as a function of temperature and "charge"; density. With almost entirely one species of particle (high charge density), we find a continuous transition to a strip of higher density oriented parallel to the drive. As the charge density is lowered, the model undergoes a continuous transition to a charge-segregated strip oriented perpendicular to the drive, followed (i.e., at lower temperature) by a first order transition into a strip parallel to the drive.

73. Pulsed Laser Deposition Diamond-Like Carbon Guides for use in Polarized Ultracold Neutron Transport

Mark Makela

The goal of this work is to obtain the best possible guides for transporting and storing polarized ultracold neutrons (UCN) for use in beta decay asymmetry experiments at LANSCE. To achieve this goal guides are made by depositing diamond-like carbon (DLC) inside quartz tubes via pulsed laser deposition of pyrolytic graphite. This technique yields guide surfaces which are smooth and highly reflective for UCN. The current state of guide development as well as DLC critical velocity, obtained by neutron reflectometry, and guide roughness will be presented.

74. 3-D animations and virtual reality environments for teaching in weed science and agricultural pest management

Peter M. Sforza and Kriton K. Hatzios

URL: <http://www.ppws.vt.edu/~sforza/gsa2001>

Three-dimensional (3-D) animations were developed as visual teaching aids for selected concepts in weed science and agricultural pest management. Visualization may enhance a viewer's perception and retention of information presented. This may be particularly important in teaching scientific or technical material containing complex concepts and a highly specialized vocabulary. Models and animations were created on a desktop computer using 3D Studio Max software from Kinetix. Animations are delivered to the student in various formats including streaming video for the web and VRML (Virtual Reality Modeling Language). VRML is the standard for interactive 3-D objects on the internet. Current and future advances in information technology provide unique opportunities for innovative teaching approaches in weed science and agricultural pest management.