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GRADUATE STUDENT ASSEMBLY

PROUDLY PRESENTS

**16th ANNUAL
RESEARCH SYMPOSIUM
OF VIRGINIA TECH**

BRIDGING RESEARCH BOUNDARIES

Keynote Speaker Colonel Nancy Jaax
Lethal Viruses, Ebola, and The Hot Zone

**MARCH 27, 2000
COMMONWEALTH BALLROOM
SQUIRES STUDENT CENTER**

Sponsored by: Graduate School, Student Budget Board, College of Architecture and Urban Studies, College of Arts and Sciences, College of Agriculture and Life Sciences, College of Engineering, College of Human Resources and Education, College of Natural Resources, College of Veterinary Medicine, Biological Sciences Initiative, Waste Policy Institute, University Honors Program, and Virginia Water Resources

Preface

The Research Symposium of Virginia Tech is a forum that provides graduate and advanced undergraduate students an opportunity to showcase their achievements in research. The symposium facilitates the interaction and exchange of ideas among faculty, staff, and students, as well as members of the public and private community from a diversity of disciplines and backgrounds.

I would like to congratulate all the participants for their outstanding accomplishments and willingness to share their research with the Virginia Tech community. All the research presented is truly impressive and serves as testimony to the high caliber of academic and research programs at Virginia Tech.

The Graduate Student Assembly is proud to provide an evening keynote address and awards presentation, starting at 6 PM in the Commonwealth Ballroom of Squires Student Center. Colonel Nancy Jaax, a leading specialist in biological hazards, will deliver the keynote address entitled "Lethal Viruses, Ebola, and The Hot Zone".

We are continuing the year-old tradition of Roundtable Discussions held during the Research Symposium. Virginia Tech faculty and students will facilitate these informal discussions on two challenging and timely topics. Additionally, we are pleased to begin a new tradition of presenting research provided by local businesses. We hope to facilitate the interactions among these local companies and the Virginia Tech community.

There are many people to thank for their diligent efforts and hard work in organizing and running this event (in alphabetical order): Laura Giese, Alexandria Graves, Hongmei Gu, Matt Habersack, Erin Hanley, John Lenio, Peter Sforza, Wes Smittle, Jeff Sutton, Paula Williams, and Dennis Wnorowski. A special thanks goes to Dr. Eugene F. Brown, Dr. John L. Eaton, Dr. Leonard K. Peters, and Joyce Rolen for their guidance and support. Additionally thanks especially to Kimberly DeGuise for all her time and effort devoted into making the event a success.

A record number of one-hundred-nine entries were received this year. Likewise, a successful fund raising campaign allowed for four prizes in each of six expanded categories. We believe this momentum will continue the growth of the Research Symposium into the future. We would like to thank our generous sponsors: the Graduate Student Assembly, the Graduate School, the Student Budget Board, the College of Architecture and Urban Studies, the College of Arts and Sciences, the College of Agriculture and Life Sciences, the College of Engineering, the College of Human Resources and Education, the College of Natural Resources, the College of Veterinary Medicine, the Biological Sciences Initiative, the Waste Policy Institute, the University Honors Program, and Virginia Water Resources.

Kali K. Phelps

Chair, 16th Annual Research Symposium of Virginia Tech-2000

The 16th 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 at 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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President: Mr. Jeff Sutton

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16th Annual Research Symposium of Virginia Tech
March 27, 2000
Commonwealth Ballroom, Squires Student Center
Roundtable Discussions

Two Roundtable Discussions will be held during the 16th Annual Research Symposium in the stage area of the Commonwealth Ballroom. Virginia Tech faculty and graduate students will facilitate these informal discussions on challenging and timely topics. This event is open to the public and participation is encouraged.

11:00 AM – 12:00 PM

“Genetically Modified Organisms and Frankenstein Foods, Fact and Fiction”
Discussion Facilitators: Dr. Mary Ellen Jones, Science and Technology Studies
Graduate Students from the Plant Pathology, Physiology, and Weed Science
“Agriculture Biotechnology Seminar”

2:00 PM – 3:00 PM

“Ins and Outs of Interdisciplinary Research Grants and Projects”
Discussion Facilitator: Michael Herndon
Center for Interdisciplinary Studies

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UNDERGRADUATE CATEGORY

1. The Role of Calcium Channels in the Effects of Pesticides on the Central Nervous System

A. Bowie* and J. Bloomquist
Department of Entomology

A correlation between a higher incidence of Parkinson's disease (PD) and agriculture areas where pesticide exposure is greater than normal has led to the theory that pesticides may play a role in the onset of PD. This evidence has caused an interest in studying how pesticides affect the nervous system and how this relates to PD. Heptachlor, and its oxidation product heptachlor epoxide, are organochlorine insecticides previously used worldwide. Evidence has indicated that heptachlor affects the function of dopamine transport and release in the nigrostriatal pathway and in cell lines expressing human dopamine transporters. In PD, nerve cells in the substantia nigra, begin to decrease in number, limiting the amount of available dopamine. The goal of this project is to more specifically examine how heptachlor as an insecticide affects dopamine release in the CNS. First, a dopamine release assay was conducted with heptachlor epoxide to see how it affects dopamine release from the synaptosomes. After these results were quantified, the release assay was ran removing all sources of exogenous calcium from the system and replacing it with cobalt ion, a calcium channel blocker. The measure of dopamine release without calcium compared to the measure of the release with calcium demonstrates that the pesticide activity is somewhat affected by the absence of calcium. This data will help to focus how heptachlor is affecting the nervous system and its possible relationship to PD.

2. Effects of Fish Oil or n-6 Fatty Acid Supplements on Immune Responses in Orphaned, Milk-Fed Lambs

E.A. Cowardin*, A.N. Fenton, M.C. Wulster-Radcliffe, J.H. Herbine, and G.S. Lewis
Department of Animal and Poultry Science

Diets rich in n-3 and n-6 fatty acids are believed to alter the immune function (Kelly et al., 1985, Prickett et al, 1982: Robinson et al., 1993). Much of the information about the role of n-3 and n-6 fatty acids in immune function is equivocal. The purpose of this experiment is to determine whether a fish oil preparation rich in n-3 fatty acids or a preparation rich in a n-6 fatty acid alters the immune system in orphaned, milk fed lambs. Treatments were arranged in 3x2 factorial arrangements of fish oil, linoleic acid, and control treatments and PHA and control treatments. Lambs were orphaned 24hrs after birth and placed on milk replacer. On days 7, 14, 21, and 28 jugular blood samples were taken for differential white blood cell counts. Weights were taken as well. Day 14 oral treatments (fish oil, linoleic acid, or control) were started. On days 14, 21, and 28 jugular samples were taken for Blastogenic analysis. PHA or saline was injected D28 and skin fold was measured every 6 hours for 24hrs. Neither n-3 or n-6 supplementation produced results to justify its use to improve the immune status of orphaned milk-fed lambs.

3. A Comparison of Alcohol and Other Drug Use of ACOAD versus Non-ACOAD College Students

K.S. DeVine*

Department of Psychology

At a southeastern four-year university, 1897 undergraduate students responded to surveys conducted in 1998 and 1999. At-risk alcohol and drug-related behaviors (vandalism, trouble with authorities, suicidal thoughts, etc.) were found to be significantly higher among students with alcohol or drug abusing parents. Some gender differences were also observed.

4. The Impact of Leadership Experiences: A Study of the Pamplin Scholars Program at Virginia Tech

M.B. Evans*

Department of Sociology

The Pamplin Scholars Program, a new Leadership Program, was started at Virginia Tech in 1998-1999. Members in this Program are called Pamplin Leaders and some participated in a Residential Leadership Community (RLC). This research explores the effects of the Pamplin Scholars Program and the Residential Leadership Community on students' leadership development. A control group of students who were not 1998-1999 Pamplin Leaders, but who were first year college students with similar QCAs of a 3.0 or better, is utilized for comparison. Data have been collected on the leadership experiences of students using both surveys and focus groups. In particular, this study focuses on the leadership roles students believe are most important, skills they have improved on since coming to college, and who the students look to for leadership role models. In the analysis of the data, several interesting findings emerge. The Residential Leadership Community dorm appears to promote a noticeable academic atmosphere among Residential Leaders; while students not in the Residential Leadership Community (non-RLC) indicate a greater commitment to service. Family members are shown to be the dominant role model for both RLC and non-RLC students. The next most frequent role model for the RLC students are educational leaders and surprisingly, non-RLC students look to their peers next. Also noteworthy is that while the highest ranked leadership role of non-RLC and RLC students is inspiring and motivating others, the highest ranked leadership role for the control group of non-Pamplin Leader students is creating vision and secondarily, inspiring and motivating others.

5. The Effect of Copper Supplementation from Bioplex(TM) Copper and Copper Sulfate on Growth Performance of Weanling Pigs

V. Hofler*, R. Schiele*, R. Simms*, E. Walter*, C.M. Wood, A. F. Harper,
and L. Kuehn

Department of Animal and Poultry Sciences

The objective of this study was to compare elevated dietary copper from an organic complex (Bioplex) or copper sulfate (CuSO₄) as a growth promotion strategy for weanling pigs. Newly weaned pigs (n = 120) were randomly assigned to four dietary treatments in six replications: 1) no added copper; 2) 50 ppm Cu from Bioplex; 3) 200 ppm Cu from Bioplex; and 4) 200 ppm Cu from CuSO₄. Phase 1 (weeks 1-2) basal diets consisted of corn, soybean meal, whey, fish meal, soy oil, and a vitamin/mineral premix. Phase 2 (weeks 3-5) basal diets included corn, soybean meal, vitamin/mineral premix, and fat. Individual pig weights and feed disappearance were recorded weekly. Fecal samples were taken from one pig in each pen on weeks 2 and 5. Results show that pens receiving Bioplex 200 outperformed control pens for average daily gain in Phase 1 (P < .05), Phase 2 (P < .10), and overall (P < .05). Average daily feed intake was also greater for Bioplex 200 pens compared to control pens throughout the study (P < .05), and tended to be greater (P < .10) than other treatments as well. Feed/gain did not differ (P < .05) among treatments. In this study, addition of Bioplex copper at 200 ppm resulted in better growth performance of weanling pigs compared to controls, but those pigs also required the greatest amount of feed.

6. Monitoring Enzyme-Enzyme Interactions in the Plant Flavonoid Biosynthetic Pathway with the Green Fluorescent Protein

A.M. Leung* and B.S.J. Winkel

Department of Biology

Flavonoids are plant secondary metabolites that aid in processes such as pigmentation, plant-microbe interaction, UV light protection and male plant fertility. The flavonoid biosynthetic pathway of Arabidopsis is a model system for the study of enzyme complexes. My project involves studying the interaction between chalcone synthase (CHS) and chalcone isomerase (CHI), the first two enzymes in the Arabidopsis flavonoid biosynthetic pathway, using fluorescence proteins, enhanced cyan fluorescence protein (ECFP) and enhanced yellow fluorescence protein (EYFP). ECFP-EYFP interaction is monitored by fluorescence resonance energy transfer (FRET), a process where an excited fluorophore transfers excitation energy to a light-absorbing molecule. FRET occurs only if distance and mutual orientations of the proteins are suitable. This work's importance lies in exploring the feasibility of using fluorescence proteins to detect protein-protein interactions, first in E.coli and eventually in live Arabidopsis plants. The use of FRET to detect interactions between CHS and CHI is being tested by fusing these enzymes to ECFP and EYFP in bacterial expression vectors and then co-expressing the fusion proteins in E.coli strain BL21 (DE3). Thus far I have created the four different constructs with CHS and CHI fused ECFP and EYFP, introduced the constructs into E.coli BL21(DE3), and received preliminary quantitative fluorimetry data on original constructs. Currently, we are continuing the test of E.coli expressing fusion proteins for evidence of interactions based on FRET.

7. Procion orange dye and force response in skeletal muscle of normal, mdx and mdx:utrophin-/- mice

S. Murphy*, C. Cable* and R.W. Grange

Department of Human Nutrition, Foods and Exercise

Duchenne Muscular Dystrophy (DMD) is a common neuromuscular disease characterized by severe muscle wasting due a disrupted dystrophin gene. The absence of this protein results in weakened membranes. Procion Orange is a low molecular weight fluorescent dye used to assess damaged muscle membranes in vitro in mdx and mdx:utrophin-/- mice, two models of DMD. The dye itself may affect muscle function independent of muscle damage. Isometric contractile responses (e.g., 1, 30, 50, 80, 100, 150 Hz) from extensor digitorum longus (EDL) muscles of normal, mdx, and mdx:utrophin-/- mice were assessed with the dye added either during or after a series of contractions. Muscles were mounted in gum tracacanth, frozen, and sections obtained with a cryostat viewed under a fluorescent microscope. Muscle damage was quantified as the number of cells to total cells taking up the dye. Procion orange dye was detrimental to force generation independent of genotype. The force generated by both dystrophic and normal muscles decreased by as much as 50% with dye added during contractions. With no dye added during contractions, muscle force was generally maintained for all genotypes (force loss about 5-10%). However, dye uptake determined in EDL during contractions compared with following contractions was similar at 15-25% for all genotypes. These preliminary data suggest that the dye can cause decreases in force generation independent of membrane damage.

8. Arrays of Optically Switchable Pixels

J. Ruiz-Avila*

Department of Physics

Large arrays of optically switchable pixels may play an important role in future optical communication and computing architectures. In such complex spatiotemporal systems, noise plays a major role. We are studying the possibility of taking advantage of the phenomenon of stochastic resonance to improve the bit error rate in a noisy or corrupted spatiotemporal array of bistable pixels. Preliminary results are presented, demonstrating low power all optical switching in dye doped liquid crystal Fabry- Perot cavities, and the effect of noise on the operation of the device as an optically addressable latch.

9. Proteasome complex proteolytic activity in normal, mdx and mdx:utrophin-/- skeletal muscle

S. Schaefer* and R.W. Grange

Department of Human Nutrition, Foods, and Exercise

Duchenne Muscular Dystrophy (DMD) is a neuromuscular disease prevalent in males. In this disease, muscle degeneration occurs in both skeletal and cardiac muscle and most patients die by age 20 years. Proteases are enzymes that break peptide bonds responsible for keeping proteins intact. One complex that may contribute to the progressive muscle degeneration of DMD is the proteasome complex, but this is not currently known. In order to understand the mechanisms which may contribute to progressive muscle wasting in DMD, we examined the rate of protein degradation by the proteasome complex in muscles from control mice and two mouse models of DMD (age ~8-15 wks). Muscle homogenates were prepared from the tibialis anterior and the muscles of the triceps surae and protein concentrations determined. Proteolytic activity was determined by incubating diluted homogenate (1:10) with a specific fluorogenic substrate. Activity was expressed as arbitrary units/ μg protein/minute ($\text{au}/\mu\text{g}/\text{min}$). Our preliminary data indicate that both mdx ($1.79 \pm 0.65 \text{ au}/\mu\text{g}/\text{min}$) and mdx:utrophin-/- ($2.45 \pm 0.45 \text{ au}/\mu\text{g}/\text{min}$) demonstrate greater activity than that for muscles of utrophin-/- mice ($0.48 \pm 0.05 \text{ au}/\mu\text{g}/\text{min}$) or control mice ($1.06 \pm 0.16 \text{ au}/\mu\text{g}/\text{min}$). These preliminary data suggest that proteasome activity could be a contributing process to the progressive muscle degeneration of DMD.

10. Internalization of *Escherichia coli* outside laboratory conditions

B.K. Seeman*, K.K. Phelps, S.S. Sumner

Department of Food Science and Technology

Foodborne illnesses in unpasteurized apple cider have been attributed to the pathogenic bacteria *Escherichia coli* O157:H7. Contamination is likely to occur during the fruit growing and harvesting phases. In apple cider production where the entire apple is pressed, pathogens found within the apple core are a potential problem. Internalization of *E. coli* in apples under natural environmental conditions was addressed in this study using a controlled outdoor setting. A surrogate *E. coli* species ATCC 25922 was used. The bacterial culture was applied to topsoil and spread evenly on a 6x6-foot area. Red Delicious, Yellow Delicious, and Rome apples were placed randomly on the soil much like a drop or windfall apple and were noted whether the apple fell calyx up, down or on its side. Apples were examined for the presence of *E. coli* and sampled on days 1, 3, 8, and 10. Skin, flesh, inner, and outer core samples were plated on MacConkey agar supplemented with cycloheximide and Mug. *E. coli* was found in the inner core and flesh samples of Yellow Delicious apples ranging from $4.86 \times 10^2 \text{ cfu/g}$ and $1.27 \times 10^3 \text{ cfu/g}$ in the inner core on days 1 and 8, and $5.38 \times 10^2 \text{ cfu/g}$ and $6.83 \times 10^2 \text{ cfu/g}$ in the flesh on days 1 and 8. Similar results were observed in the flesh of Red Delicious and Rome apples. Here, internalization was found to occur outside laboratory conditions.

11. Alterations in mouse tibialis anterior myosin isoform composition after spinal cord injury

E.R. Shockley*

Department of Human Nutrition, Foods, and Exercise

Previous studies suggest that spinal cord transection (ST), a model for spinal cord injury, results in adaptations of the mouse soleus, a slow-twitch muscle, such that the soleus atrophies and acquires a fast-twitch phenotype. However, it was not known if fast-twitch mouse muscles were similarly affected by ST. Therefore, the effects of ST on the phenotypic properties of a fast-twitch muscle, the tibialis anterior (TA), were examined. Anesthetized female mice (n = 6) weighing 20 grams were subjected to ST surgery. The mice recovered for 28 days and were terminated with pentobarbital. Age-matched non-operated mice served as controls (n = 4). The TA was dissected free, weighed and frozen in melting isopentane. Cross-sections of the TA were stained for myosin heavy chain (MHC) isoforms (markers for fast or slow phenotype) and the MHC profile of single fibers assessed. The ST TA was significantly atrophied as assessed by wet weight (~40 mg in control and ~28 mg in ST). Control mouse TA fibers mostly contained fast (type II) MHC isoforms (~39% IIb and ~52% IIa and/or IIx). The TA of ST mice contained significantly elevated proportions of fibers with IIb MHC (~79%), which is the fastest isoform. They also contained significantly decreased proportions of fibers with type I MHC, the slowest MHC isoform (~9% in control and ~3% in ST). These data are consistent with a slow to fast phenotypic adaptation of the mouse TA muscle. Thus, the atrophic and phenotypic adaptations induced by ST occur irrespective of initial muscle phenotype.

12. Economic and Environmental Implications of Overfeeding Phosphorus on Virginia Dairy Farms

S.E. Sink*, K.F. Knowlton, and J.H. Herbein

Department of Agricultural and Applied Economics & Department of Dairy Science

Algae blooms in the Chesapeake Bay have increased concern about phosphorus (P) losses from dairy farms. Phosphorus excretion, potential P losses from farms, and feed costs are all increased when P is overfed to dairy cows. A survey was conducted in fall 1998 to determine current feeding practices on Virginia dairy farms. We calculated the effect of overfeeding P on P excretion, feed costs, and acreage required to land-apply manure under P-based nutrient management regulations. Thirty-three dairy farms in environmentally sensitive areas were surveyed, and P requirements, intake, and excretion were calculated by farm, county, and feed mill. Effects of county and feed mill were not significant for any parameter. Overall average herd size was 100 cows (range: 27-280) and average milk yield was 27.7 kg/d (range: 22.7-38.6). Survey herds were representative of Virginia dairy farms (state averages: 106 cows/herd and 28.1 kg/d milk). Calculated dietary P requirement averaged 72 g/d or .34% of dietary DM. Dietary P content averaged .49% (+ 45%), and ranged from .35% (+1.7%) to .65% (+125%). Estimated nutrient uptake by crops was used to calculate acreage required to land-apply manure under P-based nutrient management regulations. Increasing dietary P from the required .34% to the survey average of .49% increased acreage requirements for manure disposal by 71% and increased feed costs by \$800 to \$2800/year depending on current P intake. Reducing dietary P intake to published requirements is a cost-effective technique to reduce P losses and improves farmers' ability to meet new P-based nutrient management regulations.

13. A Comparative Study of Wood Decomposition in a Small Fresh Water Stream and a Tidal Saltwater Creek

D. Sobota*, J.R. Webster, G.M. Simmons Jr.
Department of Biology

Wood decomposition is an important mechanism for energy flow and nutrient cycling in many aquatic ecosystems. According to previous studies, wood decays faster in marine systems compared to freshwater systems. We placed white oak veneer strips in a headwater stream at Coweeta Hydrologic Laboratory, Macon County, NC, and in a tidal saltwater creek at the Eastern Shore of Virginia National Wildlife Refuge, Kiptopeke, VA, to study the mechanisms of wood decay in these two ecosystems. We collected veneer strips from both sites several times over one year and compared macroinvertebrate colonization, biofilm respiration, and ash free dry mass (AFDM) remaining between sites. Results indicate that wood in the saltwater creek had higher numbers of xylophagous macroinvertebrates, higher biofilm respiration rates, and faster decreases of AFDM compared to wood in the freshwater stream. We believe faster decomposition occurred in saltwater compared to freshwater because: 1) greater numbers of xylophagous macroinvertebrates and 2) increased wood surface area exposed to microbial colonization as a result of macroinvertebrate activity.

14. Upregulation Of FAS Ligand In Various Tissues Following TCDD Administration

M.T. Sproull,* A. Zeytun, M. Nagarkatti, L.M. Hudson, R. Duncan, P.S. Nagarkatti
Departments of Biomedical Sciences and Pathobiology, and Biology

Previous studies from our laboratory demonstrated that 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) induces apoptosis in thymocytes of C57BL/6 wild-type but not Fas-deficient C57BL/6- lpr/lpr or Fas ligand (L)-defective C57BL/6- gld/gld mice. In the current study, we tested whether TCDD would increase the expression of Fas and/or FasL. When C57BL/6 wild-type mice were injected with 50mg/kg body weight TCDD, there was a significant upregulation of FasL but not Fas in the thymus 1 or 5 days after treatment, as detected by semi-quantitative RT-PCR. On day 5, FasL but not Fas expression also increased in the spleen, lymph nodes, liver, lungs and testes. The upregulation of FasL in the thymus was detected at lower concentrations of TCDD including 0.1, 1 and 10 mg/kg body weight. When the organs from wild-type, lpr and gld mice treated with 50mg/kg body weight of TCDD were histopathologically analyzed, on day 5, no significant changes in the lungs, lymph nodes, spleen and testes were observed. The thymus of all three strains exhibited hypocellularity after TCDD exposure. TCDD-treatment also induced hepatocellular vacuolation in wild-type and lpr strains, and to a lesser extent in the gld strain. The TCDD-treated wild-type and gld strains also exhibited multifocal inflammatory cell foci in the liver, which was lacking in the lpr strain. These data indicate that Fas-FasL interactions play an important role in TCDD-induced toxicity (Supported in part by grants from NIH, Sigma Xi and EPA).

15. Development and Sensory Evaluation of a Soy Protein/Gingerbread Muffin

L. Taylor*

Department of Human Nutrition, Foods, and Exercise

Physicians and researchers alike struggle with ways to prevent or treat coronary heart disease, a condition prevalent among the American public that results in thousands of deaths each year. Soy protein isolate (SPI) has been found to lower high levels of plasma total cholesterol and low-density lipoprotein (LDL) cholesterol, which are risk factors of heart disease. Recently, the Food and Drug Administration (FDA) has stated that food labels of certain products containing soy protein are allowed to declare that soy may lower the risk factors of heart disease. In this research we developed a soy product that may be used in encouraging the public to consume more soy containing foods. Gingerbread muffins were prepared according to seven different recipes. The SPI content of each muffin varied from 8.6 to 14.7 g according to the recipe. Upon sensory evaluation of the products, it was found that ratings were consistently favorable, but dropped once the muffin contained approximately 12.1 grams of soy, at which point soy could no longer be added without sacrificing acceptability. The overall rating of the control muffin, containing no SPI, was the same as the muffin containing 10.4 g SPI and was lower than the rating of point the muffin containing 12.1 g. If consumed three times each day, this muffin supplies a total amount of 36.3 g SPI proven to lower high plasma cholesterol levels. The substitution of soy in the soy protein gingerbread muffin verified that the general public enjoyed consuming a soy-containing product.

16. Isolation and Sequencing of Phaseolus vulgaris MIPS for Comparison to Soybean

A. Vance*, R. Hanlon⁺, C. Hegeman⁺, and E. Grabau⁺

*Department of Biology and ⁺Department of Plant Pathology and Weed Science

Myo-inositol-3-phosphate synthase (MIPS) is a key enzyme involved in the biosynthesis of phytate, the storage form of phosphorus in plant seeds. Phytate is not efficiently utilized by monogastric animals. Lowering MIPS should reduce phytate levels in seeds to improve phosphorus availability. The MIPS gene sequence has been reported for corn, barley, ice plant, rice, Arabidopsis, soybean, and Phaseolus vulgaris. A phylogenetic alignment of the sequences showed a closer relationship between the sequences of Arabidopsis and Phaseolus (both reported by the same laboratory) than between the sequences of soybean and Phaseolus, which are both legumes. Our objective was to sequence a portion of the Phaseolus gene to test the possibility that an error occurred in the sequencing or reporting of the Phaseolus sequence. Primers for MIPS were used to amplify a PCR product from isolated Phaseolus DNA. The PCR product was inserted into the vector pBluescript-KS. The construct was electroporated into Escherichia coli cells and transformants selected. The plasmid was isolated and the MIPS insert sequenced. The sequence was compared to the MIPS sequences of other legumes, including the published Phaseolus sequence. Our Phaseolus sequence was very similar to the soybean sequence and phylogenetic analysis places Phaseolus more closely related to soybean than to Arabidopsis, consistent with our hypothesis.

17. A Spatio-Temporal Analysis of Turbulent Flows Using Quantitative Flow Visualization

P.P. Vlachos*

Department of Engineering Science and Mechanics

Turbulent flows and represent a great scientific challenge because of their complexity as well as their great engineering importance. In order to be able to investigate such flows the limits of conventional experimental methods need to expand and provide accurate and detailed information in a spatio-temporal domain. A very important evolution in the area of experimental fluid mechanics is the development of imaging techniques for instantaneous measurements of a whole flow field in two or three dimensions. The success of such methods depends on the integration of the continuously increasing computational power, with high-resolution high-speed CCD cameras (Charged Coupled Device) and high power lasers. The scope of the current research is to incorporate the aforementioned hardware with analytical, statistical and signal/image processing methods to allow the researcher to analyze the finest and smallest scales of turbulence. Thus, a versatile, interdisciplinary method is been developed. In the final presentation, the basics of the method with its advantages and limitations will be presented. The necessary hardware and software will be described. Results of the application of the method to three-dimensional unsteady flow fields will be presented. The presented applications will include: The flow over a low-rise structure, which is associated to wind loads and is of great importance to extreme wind hazard mitigation process. The flow around bodies piercing water free surface that involves the interaction of surface gravitational waves, solid bodies and free-shear boundaries and is of great significance to the offshore structure design as well as naval architecture. The influence of low energy flow control to separated flows over airfoils that will improve the performance of the next generation airplanes. In all cases, the application of the method reveals underlying characteristics of the flow field that up to now were unknown to researchers.

18. Erosion patterns in shot types ingested by blue-winged teal, *Anas discors*

K.C. Walski*, P. F. Scanlon, J. R. Craig⁺ and M. H. Sherfy

Department of Fisheries and Wildlife Sciences

⁺Department of Geological Sciences

Spent shot is frequently ingested by waterfowl and upland bird species. The gizzards of birds are the usual sites of shot retention wherein the shot are subjected to physical grinding and chemical erosion in the highly acidic gizzard environment. To study erosion patterns of blue-winged teal (*Anas discors*) 3 #4 lead, copper-jacketed lead, or steel shot were force-fed to each of the three adult teal. Shot were recovered from the gizzards after 1, 2, or 3 days, weighted and prepared for light and electron microscopy. Weight changes in recovered shot were unremarkable. Copper-jacketed shot appeared to be of a darkened color after 3 days in the gizzard, presumably indicative of erosion of the copper jackets. Indentations in the surfaces of the latter shot were apparent with light microscopy. The surfaces of lead and steel shot did not indicate unusual chemical compounds or wear patterns. However, copper-jacketed shot recovered after 3 days in the gizzard had pits in the copper jackets beneath which there was substantial erosion of the underlying lead. The pits were manifest as discontinuous areas in the sections of the copper jackets.

19. Effects of Dietary Nickel on Performance and Bone Strength of Male Broilers

E.J. Wilson* and J.H. Wilson
Department of Biological Systems Engineering

Effects of Dietary Nickel on Performance and Bone Strength of Male Broilers. The effects of dietary nickel (0,25,50,75, 100, and 150 mg/kg) on the bone strength characteristics and performance of male broilers was investigated. Broilers were housed in either cages or pens. At 6 weeks of age, the shear fracture energy of the tibia from the caged birds increased when the basal diet was supplemented with 25 milligrams of dietary nickel per kilogram of feed (mg/kg). The shear force, stress, and fracture energy of the radius from the caged birds also increased at 25 mg/kg nickel. Dietary nickel had no affect on bird weight but the caged broilers (2161g) were heavier than the floor birds (1005g). Nickel had no effect on the strength characteristics of the tibia from the floor birds. Percent tibia bone ash, a measure of bone density, was not influenced by dietary nickel but the tibia ash of the floor birds was greater than the caged birds. Overall, the data indicates that adding 25 mg/kg to a broiler diet will have a positive influence on bone strength characteristics and performance.

20. The Potential for Pigmentation to Expand Market Demand for Virginia Rainbow Trout

M. Young* and E. Jones
Department of Agricultural and Applied Economics

Trout growers in Virginia are facing low profits and increased competition from large-scale producers in Idaho. Growers in Virginia realize they must diversify their product line in order to stay competitive. The objective of this study is to examine the potential for selling pigmented rainbow trout as a specialty product, thus increasing the profit margin for the Virginia trout grower. This pigmentation process is accomplished by adding Astaxanthin to the feed. Due to this process the skin becomes more brilliant and the meat turns to specific predetermined shades of reddish-pink, much like that of salmon. Results of a marketing survey of 200 retail store customers, conducted in the target market, revealed that 75 percent of the sample population have total household income over \$50,000. They would also be willing to pay a weighted average premium of \$.29 per pound for fresh Virginia trout rather than frozen out-of-state raised trout. Out of eight purchasing factors considered, 92 percent said taste was an important factor, 91 percent said appearance of freshness was important, and 71 percent indicated that color of meat was important in their decision. The survey indicated that the target market would have a high percentage of customers in and above \$75,000 income with a household structure of two adults and one child/teenager. Since the pigmentation process causes the trout meat to look like salmon meat, trout could be positioned as a more affordable substitute to salmon, which had the highest consumption rating of any other fish on the survey.

AGRICULTURAL & ANIMAL SCIENCES CATEGORY

21. Evaluation of Metolachlor and Pebulate in Plasticulture Tomatoes

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Department of Plant Pathology and Weed Science

Field experiments were initiated in 1999 at the Eastern Shore Agricultural Research and Experiment Center near Painter, VA to evaluate tolerance of tomatoes to metolachlor and pebulate. All herbicides were applied just prior to planting. Following herbicide application, beds were covered with black plastic and 'Agro Set' tomato were planted 12 inches apart into the beds. Treatments included metolachlor (Dual Magnum 7.62 EC) at 0.75, 1.0, and 1.5 lb/A; pebulate (Tillam 6.0 EC) at 3.0, 4.5, and 6.0 lb/A; and a nontreated check. Crop injury was visually estimated at 2, 3, and 9 weeks after treatment (WAT). Tomatoes from each plot were separated into culls (malformed or tomatoes less than 2.25 inches in diameter as determined by a mechanical presizer), medium (< 2.75 inches), large (< 3.5 inches), and jumbo (> 3.5 inches). There were no significant treatment effects for injury found between herbicide-treated plots at each injury evaluation. Injury from herbicide treatments ranged from 11-19% at 2 WAT, 7-17% at 3 WAT, and 5-11% at 9 WAT. Injury was numerically, although not significantly, highest from metolachlor at 1.5 lb/A (19, 17, and 11% at 2, 3, and 9 WAT, respectively) and lowest from metolachlor at 0.75 lb/A (13, 11, and 5% at 2, 3, and 9 WAT, respectively). Injury from pebulate at any rate ranged from 12-13% at 2 WAT, 7-11% at 3 WAT, and 5-9% at 9 WAT. All herbicide treatments generally had little or no effect on tomato grade and total yield in comparison to nontreated plots.

22. A Study on Outdoor Sound Propagation: A Computer Implementation to Predict Sound Pressure Levels in Open Air

O. Cakir*

Department of Architecture and Urban Studies

This research analyzes prediction methods used to determine attenuation in outdoor sound propagation. Both experimental and provisional data, from various studies done for prediction of sound/noise levels in open air, have been compiled and a method using a computer code with a simplified mathematical model is proposed to predict pressure levels of sound propagating outdoors. The proposed method was basically built up around formulas contained in International Standards Organization's Standards for "Calculation of attenuation of sound during propagation outdoors". A review on both theoretical and experimental works has been held and results from the developed computer code showed considerable affinity with the measured data. The discordance recorded between the measured and the predicted data is explained in terms of sound diffraction and reflection mechanisms and atmospheric turbulence, a derivative of wind and temperature gradients which were not taken into account by the proposed method. However, the method and the computer code developed should be accepted beneficial as being practical references without flannel and undue mathematics, offering concise guidance and assisting in design methodology.

23. The effect of genistein on antioxidative defence systems and plasma lipid profiles in aged rats

C.Y. Chen*

Department of Human Nutrition, Foods & Exercise

Nine male Sprague-Dawley rats, aged two years, were assigned to two groups; high and low genistein diets, respectively. Complete basal diets from AIN were supplemented with 500 and 250 PPM genistein in diets. After four weeks on the diets, blood was drawn from each rat, immediately following sacrifice. Antioxidant enzymes (superoxide dismutase, catalase, and glutathione peroxidase) in red cells and plasma genistein and TBARS were measured, as well as plasma lipid profiles. The activities of three antioxidant enzymes were not significantly different in rats fed different levels of genistein. The amounts of total triglyceride and cholesterol and low density lipoprotein cholesterol were significantly decreased in rats fed 250 vs. 500 PPM genistein diets (244 vs. 390 mg/dl, 223 vs. 443 mg/dl, and 134 vs. 306 mg/dl, respectively) ($P < 0.05$). Plasma genistein concentrations in rats fed 250 PPM genistein diet were not significantly lower than rats fed 500 PPM genistein diet (109.1 vs. 201.0 ng/ml). Genistein concentration in plasma (201.1 ng/ml) was lower than the value that we reported before (348.5 ng/ml) even though rats (one-year old) in the earlier study were given equal amounts of genistein in similar diets ($P = 0.06$). Plasma malondialdehyde levels were significantly lower in rats fed 250 vs. 500 PPM genistein supplemented diet (1.6 vs. 2.48 nmoles/mg protein) ($P < 0.05$). High plasma genistein concentration, maybe exceeding the physiological threshold, might enhance the oxidative stress if any active oxidant was present. The results imply that 500 PPM genistein from dietary supplementation might have prooxidant activity.

24. Quantification of Critical Microleak Size for Maintenance of Hermetic Food Packages

M. Gibney*, J. Marcy, and B. Blakistone

Department of Food Science and Technology

Sterility maintenance assurance is of paramount importance for the food processor. Defects in packaging materials have been implicated in many spoilage episodes of food products. There are many package inspection systems available that rely on physical testing of the package to indicate the possibility of microbial contamination. A physical test is much quicker and more sensitive than a microbial challenge test, however, a microbial challenge indicates conditions for microbial contamination. Critical limits for microbial contamination have not yet been examined thoroughly enough to compare physical tests to microbial tests. One of the main factors directly affecting the critical leak size is whether or not the microleak is filled with liquid. Early leak studies with contaminated cans showed that microorganisms penetrated the can through a liquid filled defect. A mathematical model has been developed to predict liquid penetration of a package defect using test cells fitted with nickel microtubes of varying micron sizes representing defects. Leak initiation was examined in terms of the interaction among three components: surface tension of the contained product, defect size, and internal pressure required to initiate flow. This model was used in determining the microhole size required at a certain pressure to allow leak initiation of various liquid products in differing package sizes. Liquid filled nickel microtubes exposed to a bioaerosol have been previously used to evaluate the critical leak size of a liquid filled defect. This research will involve testing air filled nickel microtubes against a bioaerosol. The results of this research will lend to establishing critical leak size predicted by a mathematical model.

25. Characterization of Host Plant Responses to Broomrape (Orobanche) Using RNA Analysis and Indicator Genes

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Department of Plant Pathology, Physiology, and Weed Science

Orobanche is a parasitic plant that attacks the roots system of many important crops. In order to investigate how the host plant responds to this attack, we are studying the patterns of expression of host genes, with emphasis on those involved in the mevalonic acid pathway. We have previously shown that *hmg2*, known to be specifically induced in defense situations, is expressed at the site of Orobanche parasitization in transgenic tobacco (*Nicotiana tabacum* L.). A second isogene, *hmg1*, differs from *hmg2* in that it plays a role in general metabolic processes related to plant development, and is expressed in response to wounding rather than by specific pathogen interactions. In this study, tomato (*Lycopersicon esculentum* Mill) plants containing *hmg1*-GUS fusions were assayed, and Northern hybridization analysis was performed using *hmg1* specific probes. Results indicated that *hmg1* is also expressed during parasitization. Another gene in the pathway, squalene synthase, is similar to *hmg1*, however, squalene synthase is induced in response to wounding yet repressed in response to pathogen elicitors. Results from Northern hybridization analysis of Orobanche-infected tissue indicated that unlike *hmg1*, squalene synthase is repressed in tissue parasitized by Orobanche. Together, these results indicate that the plant seems to shift metabolic energy away from cell maintenance in favor of defense and repair. By comparing the regulation of these three genes in response to Orobanche attack, we are able to gain a greater understanding of the host plants response to parasitization.

26. TCDD-Induced Apoptosis in the Thymocytes of Perinatally-Exposed Neonates

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2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) is a highly toxic environmental contaminant. The immune system is highly sensitive to TCDD and therefore this contaminant has raised significant health concerns. Recent studies from our laboratory demonstrated that TCDD treatment triggers apoptosis in thymocytes of adult C57BL/6 mice. Also, prenatal administration of TCDD has been shown to have profound immunotoxic effects. In the current study we tested the hypothesis that prenatal administration of TCDD results in immunotoxicity due to induction of apoptosis in thymocytes of the neonate. To this end, pregnant female C57BL/6 mice were given a single intraperitoneal injection on gestational day 14 with 0.1, 1, or 5?g/kg body weight TCDD or the vehicle, as a control. On postnatal days 2, 4, 7, 14, and 21, the thymocytes were isolated and studied for apoptosis using terminal deoxynucleotidyl transferase (TdT) and fluorescein isothiocyanate (FITC-dUTP). We found that thymic cellularity and percent viability of the thymocytes was decreased in the pups exposed to the highest dose of TCDD, when compared to the control. On postnatal days 2 and 4, but not subsequently, thymocytes from TCDD-exposed pups showed increased apoptosis upon in vitro culture, when compared to the control. These results indicate that TCDD-induced toxicity in perinatally-exposed neonates is due to induction of apoptosis in the thymocytes (Supported in part by grants from EPA and NIEHS).

27. Effects of TCDD on Primary Toxoplasmosis in C57/BL6 Mice

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In the current study, the effect of of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) on infection caused by *Toxoplasma gondii*, a protozoan parasite, was studied. C57BL/6 mice were fed 25 tissue cysts of *T. gondii* and treated with sodium sulfadiazine to prevent death from acute disease. Six weeks later, mice were treated with 50 μ g/kg body weight TCDD and the extent of infection and immune status was determined. TCDD treatment of chronically infected mice did not cause differences in brain lesions or *T. gondii* tissue cyst numbers. It was, however, observed that there was a significant decrease in the thymic cellularity in uninfected or *T. gondii*-infected mice treated with TCDD but not the vehicle. Furthermore, alterations in the percentage and absolute numbers of CD4+, CD8+, CD4+CD8+and CD4-CD8- T cells were observed in *T. gondii*-infected mice following TCDD treatment. However, there were no changes in the splenic cellularity and T cell subsets in all groups of mice. Next, whether prior treatment with TCDD would influence the course of an acute infection with *T. gondii* in C57/BL6 mice was investigated. The results demonstrated that 50% of the vehicle-treated *T. gondii* infected mice and 100% of TCDD-treated *T. gondii* infected mice died from acute toxoplasmosis 11 to 13 days post-infection as indicated by the presence of tachyzoites in liver and lung impression smears. Results of the present study indicate that prior exposure to TCDD can exacerbate a primary *T. gondii* infection in C57/BL6 mice.

28. Identification of pathogenic bacteria in biofilms of recirculating aquaculture systems

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Department of Food Science and Technology

Aquaculture has become the fastest growing segment of world agriculture. Recirculating aquaculture offers the greatest potential for success since it requires limited resources, and is independent of environmental conditions. However, this form of aquaculture presents a potential unacceptable public health risk. With growing concerns for increased antibiotic resistant organisms, controlling pathogenic microorganisms is paramount. Biofilms form on all aquaculture system components, incorporating microflora present in the water. Pathogenic microorganisms are found in this biofilm, causing recurring exposure to disease and the presence of asymptomatic carriers. The project objective is to increase the understanding of pathogen incorporation into biofilms in recirculating aquaculture systems by determining their ability to attach to various materials used in construction of those systems. Two mariculture, one hydroponics, and six freshwater aquaculture facilities were sampled, with eight different types of material tested. Pathogenic bacteria were identified using BAM methods and the Becton-Dickinson BBL Crystal ID Kit. Various pathogenic bacteria were identified, including *Aeromonas hydrophila*, other *Aeromonads*, *Vibrios*, *Yersinias*, and *Bacillus cereus*. The most significant variation in biofilm pathogens was observed in facility type and not construction material. Some of the microorganisms identified are pathogens for both fish and humans and can be significant in further processed seafoods. *Bacillus cereus* is a spore-forming bacteria which is thermally resistant, making it difficult to eliminate with normal food processing techniques. *Vibrio* species were found in the biofilms in both freshwater and saltwater systems. Some *Yersinia* species, such as *Yersinia enterocolitica*, are becoming more recognized as food or water-borne pathogens. Whether the presence of these organisms in biofilms could lead to food-borne illness is unclear, but the potential is there. More research on pathogenic organisms in biofilms is required. Because the materials used for facility construction were not significant, increased biosecurity measures leading to pathogen elimination should also be investigated.

29. Adenosine Tri-Phosphate (ATP) Concentration in Hen Sciatic Nerves Affected with Organophosphorus Ester-Induced Delayed Neuropathy (OPIDN)

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Continuing local supply of ATP is critical for anterograde and retrograde axonal transport and other nerve fiber functions (Goodrum and Morell, Neurotoxicology, 1992). To assess the role of alterations of ATP in OPIDN, we evaluated concentrations of that molecule in hen peripheral nerves following exposure to an organophosphate capable of inducing delayed neuropathy. To provide an appropriate model of OPIDN, a single 2.5 mg/kg dose of phenyl saligenin phosphate (PSP) was administered to adult hens. ATP concentrations were determined at days 2, 4, 7, and 14 post-dosing, from five segments ($n = 5/\text{group}$) representing the entire length of the sciatic nerve. Initial effects of PSP dosing was seen in the most distal segment of sciatic nerve at day 2, when a transient ATP concentration increase (388 ± 79 pmol/ml/mg vs. control value of 215 ± 23 , $p < 0.05$) was noted. Subsequently, ATP concentration in this distal segment returned to normal. In all other nerve segments, ATP concentration decreased with time, and was significantly lower than control values on day 14 post-dosing ($p < 0.05$). Changes in ATP concentration corresponded to incidence of decreased nerve conduction velocity, beginning 2 days post-dosing ($p < 0.01$), and preceded development of clinical neuropathy and axonopathic lesions. These results suggest that variations in sciatic nerve ATP concentration are early events in the development of OPIDN.

30. Seasonal abundance and diversity of aphids in Jamaican hot pepper cropping systems

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Department of Entomology

The aphid vectored viruses, Potato Virus Y and Tobacco Etch Virus, are major factors limiting the production of hot peppers, *Capsicum* spp., in Jamaica. These viruses are stylet-borne and are non-persistently transmitted by a number of aphid species. To date, only *Myzus persicae* (Sulzer) and *Aphis gossypii* Glover have been associated with hot pepper cropping systems in Jamaica. The objectives of this study were to identify all aphid species and to determine their seasonal abundance in an area where hot peppers are grown. Three yellow-green mosaic pan traps were placed on each of three farms. Traps were monitored weekly, the winged aphids were identified and the number per trap was recorded. Farm 1 had the highest mean number of aphids (per trap) per week (8) > Farm 2 (7) > Farm 3 (2). Generally, aphid abundance was greatest from February through mid-April 1998 and from mid-September 1998 through mid-May 1999. On Farm 1, the most common aphid species were *Aphis amaranthi* Holman, *Uroleucon ambrosiae* complex and *A. gossypii*. On Farm 2 the most abundant aphid species were *Myzus persicae*, *U. ambrosiae* complex and *A. gossypii*. *A. gossypii* was most abundant on Farm 3. Aphid abundance was lowest during the hot summer months in both years. The importance of aphid seasonal abundance is discussed in terms of developing a management program for aphid transmitted viruses.

31. Subacute Intradermal cis-Urocanic Acid Suppresses Thymic Cellularity in Two Strains of Mice

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Urocanic acid predominates in the stratum corneum of mammals in the trans isomer form. Exposure to ultraviolet light causes isomerization to the cis isomer, which is then partially absorbed systemically. Excessive cis-urocanic acid (cUCA) has been suggested to be involved in sunlight-induced local and systemic immunosuppression. In this study, cUCA was administered intradermally in two strains of 6 week-old female mice (C3H-HeN and C57BL/6) for one day, five consecutive days, or three times a week for four weeks. The following parameters were measured 48 hours after administration of the final dose of cUCA as indicators of alterations in immune function: thymic and splenic organ weights, total cellularity and leukocyte cellularity of the thymus and spleen, splenic macrophage phagocytosis, and splenic leukocyte production of hydrogen peroxide (chemiluminescence assay). Significant decreases in thymic leukocyte cellularity were seen in both strains of mice in the four-week dosing regime, supporting previous observations of thymic effects in mice exposed subacutely to cUCA. (Supported by NIH RO1-ES 09642-01).

32. Endostatin Concentrations in Healthy Dogs and Dogs With Selected Neoplasms

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Endostatin, a carboxy-terminal fragment of collagen XVIII, prevents angiogenesis and tumor growth by inhibiting endothelial cell proliferation. The purpose of the study was to determine serum endostatin concentrations in 53 healthy dogs and 38 dogs with selected cytologically and/or histologically confirmed, untreated neoplasms. Endostatin concentrations were determined using a competitive enzymatic immunoassay (EIA), with rabbit polyclonal antibody generated against a recombinant canine endostatin protein (Accucyte® Canine Endostatin- Cytimmune Sciences, Inc.) Mean (mean + SEM), and median endostatin concentrations in healthy dogs were 92.4 + 4.0 ng/ml and 82.5 ng/ml. Dogs with lymphosarcoma (LSA) and hemangiosarcoma (HSA) had mean and median endostatin concentrations of 110.9 + 5.4 ng/ml and 93.7 ng/ml, and 113.2 + 6.2 ng/ml and 122.7 ng/ml, respectively. Endostatin concentrations in dogs with neoplasia were significantly higher than healthy dogs (p=0.0011). Serum concentrations of endostatin between dogs with LSA and HSA were not significantly different (p=0.7838). Age of dogs was associated with serum endostatin concentration for all groups of dogs (p<0.0001).

35. Comparative Study of Semisynthetic Derivative of Natamycin and the Parent Antibiotic on the Spoilage of Shredded Cheddar Cheese

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The polyene macrolide antibiotic natamycin (Antibiotic A-5283) is used to retard the growth of surface molds on various cheese varieties. It is applied to the surface of cheese by dipping or spraying, using an aqueous dispersion containing 200 to 300 ppm of the additive. The large molecular weight of natamycin, 666 g/mol, and conjugated double bond structure causes it to be extremely insoluble in water and most food grade solvents. The inability to apply natamycin in true solution creates void non-treated areas on the food surface. These non-treated areas may allow the growth of fungal organisms. A water soluble N-alkyl semisynthetic derivative of natamycin was synthesized by the Michael addition reaction of the parent with a N-substituted maleimide. A comparative study investigated the effectiveness of the semisynthetic derivative of natamycin and the parent antibiotic in suppressing mold growth, on shredded Cheddar cheese stored under modified atmosphere (MA). The effects of 0, 10, and 20 ppm antimycotic treatments were examined. A 20 ppm natamycin treatment effectively suppressed visible mold growth (<104 CFU/g) in MAP samples for up to 30 days after opening. The 20 ppm semisynthetic derivative performed similarly to the 10 ppm natamycin treatment. Visible mold growth did not occur for these treatments in MAP samples until 20 days after opening. Analysis of storage conditions revealed that an outgrowth of mold in shredded cheese occurred in MAP packages stored longer than 15 days. This bloom in mold growth was attributed to the degradation of natamycin and the derivative throughout storage.

36. Detection of Feline Leukemia Virus in Bone Marrow Using Polymerase Chain Reaction

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Latent Feline Leukemia Virus (FeLV) infections, in which proviral DNA is integrated into host DNA, but not actively transcribed, are suspected to be associated with many diseases. Bone marrow is the suspected site of the majority of latent infections. The purpose of this study was to determine if polymerase chain reaction (PCR) could detect FeLV proviral DNA in bone marrow and provide a method of detecting latent infections. Blood and bone marrow samples from fifty cats and bone marrow from one fetus were collected; sixteen of which had FeLV-associated diseases. Serum ELISA, blood and bone marrow immunofluorescent antibody test (IFA), and blood and bone marrow PCR were performed on each cat, and IFA and PCR on bone marrow of the fetus. Forty-one cats were FeLV negative. Five cats and one fetus were persistently infected with FeLV. Four cats were discordant; two ELISA positive with other tests negative, one bone marrow IFA negative with other tests positive, and one bone marrow IFA positive with other tests negative. No cats were positive on bone marrow PCR only. These results indicate that PCR can detect FeLV in bone marrow, but no cats in this study harbored FeLV in the bone marrow only. Not all cats with FeLV-associated diseases are persistently or latently infected with FeLV.

37. Effects of recombinant equine IL-1 on proteoglycan metabolism in equine articular cartilage explants

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The purpose of this study was to evaluate the effect of recombinant equine IL-1b (rEqIL-1b) and recombinant equine IL-1a (rIL-1a) on proteoglycan metabolism in equine articular cartilage explants and to establish culture conditions for the use of the rEqIL-1/equine articular cartilage explant model for the study of equine joint disease. Articular cartilage was removed aseptically from a stifle joint of a horse euthanized for reasons unrelated to joint disease. Samples were cut into explants (50mg) and randomly assigned to groups without (control) or with rEqIL-1b or rEqIL-1a treatments (0 - 500 ng/ml) in quadruplicate wells. Proteoglycan degradation was evaluated by [³⁵S]O₄ labeled GAG levels released into explant media as well as DMMB-labeling and spectrophotometric analysis (Days 2,4,6). Proteoglycan synthesis within the explants (Days 2,4) was evaluated using [³⁵S]O₄ GAG incorporation and alcian blue precipitation. All data was normalized for explant mass and DNA content, with final units in ug / ng DNA and cpm / ng DNA. A 3-way ANOVA model was used to fit the data. A combined pattern of GAG degradation and inhibition of GAG synthesis was induced by both rEqIL-1b and rEqIL-1a at concentrations as low as 0.1 ng/ml (p<0.0001). These results demonstrate the potent effect of rEqIL-1b and rEqIL-1a on proteoglycan metabolism in equine cartilage and justify the use of this in-vitro model in future related studies.

38. Effect of Shelf-life and Light Exposure on Acetaldehyde Concentration in Milk Packaged in HDPE and PETE Bottles

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Whole milk (3.25% milkfat) was packaged in clear glass, high density polyethylene (HDPE), clear poly(ethylene terephthalate) (PETE), clear PETE with UV barrier, and amber PETE containers and exposed to fluorescent light at 1100-1300 lux (100-120 FC) for 18 days at 40C. Two levels of light exposure (light-exposed or light-protected) were evaluated for each packaging treatment. Control (glass) and treated milks were evaluated by sensory and instrumental methods on day 0, 7, 14, and 18 of storage. Intensity of oxidation, acetaldehyde, and lacks freshness off-flavors was determined by eight experienced panelists. No significant difference was found in acetaldehyde off-flavor between bottle treatments (exposed or protected). The concentration of acetaldehyde that developed over time in any of the containers also never exceeded flavor threshold levels for acetaldehyde in milk. In light-exposed samples, oxidation off-flavor was significantly less when packaged in amber PETE versus the other containers. Milk packaged in HDPE containers also showed a significantly higher level of oxidation off-flavor on day 7 and 18 than milk packaged in PETE containers with UV block, but not from clear PETE or glass containers. Lacks freshness off-flavor increased over time, as expected, in light-exposed and light-protected bottles and was more intense in the light-exposed containers over the first fourteen days. Instrumental analysis (solid phase micro-extraction gas chromatography) showed increases in compounds associated with light oxidized flavor (acetaldehyde, pentanal, dimethyl disulfide (DMDS), and hexanal) in light-exposed samples over time.

39. Tocopherol (Vitamin E) content in three invasive, woody species commonly found on unmanaged Appalachian pastures

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Department of Biochemistry

The tocopherol (Vitamin E) content of forage from tree invasive, shrub species was examined to assess the potential dietary intake of Vitamin E for goats browsing on overgrown Appalachian pastures. Tocopherol levels were measured in multiflora rose (*Rosa multiflora* Thunb.), autumn olive (*Elaeagnus umbellata* Thunb.) and Morrow's honeysuckle (*Lonicera morowii* Gray). Plant tissue was collected from replicated plots at a site in Southern West Virginia. Tocopherols were extracted with hexane, separated by HPLC on a normal-phase diol column, and quantified.

40. Ozone Exposure Alters Chlorophyll Fluorescence and CO₂ Exchange rate in Two Tobacco cultivars

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Department of Plant Pathology, Physiology and Weed Science

Two tobacco cultivars (*Nicotiana tabacum* L.), Bel-B and Bel-W3, tolerant and sensitive to ozone, respectively, were grown in a greenhouse supplied with charcoal filtered air and exposed to 200 ppb ozone for 4hr. Effects on chlorophyll fluorescence, net photosynthesis, and stomatal conductance are described. Quantum yield was calculated from chlorophyll fluorescence and the initial slope of the assimilation-light curve measured by the gas exchange method. Only the sensitive cultivar, Bel-W3, developed visual injury symptoms on up to 50% of the 5th leaf. The maximum net photosynthetic rate of ozone-treated plants was reduced 40% compared to control plants immediately after ozone fumigation in the tolerant cultivar; however, photosynthesis recovered by 24hr post fumigation and remained at the same level as control plants. On the other hand, ozone exposure reduced maximum net photosynthesis up to 50%, with no recovery, in the sensitive cultivar apparently causing permanent damage to the photosystem. Reductions in apparent quantum efficiency, calculated from the assimilation-light curve, differed between cultivars. Bel-B showed an immediate depression of 14% compared to controls, whereas, Bel-W3 showed a 27% decline. Electron transport rate (ETR), at saturating light intensity, decreased 58% and 80% immediately after ozone treatment in Bel-B and Bel-W3, respectively. Quantum yield decreased 28% and 36% in Bel-B and Bel-W3, respectively.

41. Potato hmg-1 Promoter Studies in Tobacco Plants

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Department of Biochemistry

The potato Hmg1 gene is rapidly activated by wounding. The promoter controlling transcription of this gene could prove to be quite valuable in the production of human proteins in plants. A gene for a therapeutic protein could be placed under the control of this promoter and the rapid activation would allow for extensive protein production in harvested tissues. This would be beneficial because high-level production of foreign proteins by plants over time may be detrimental to the plant. A b-glucuronidase (GUS) reporter gene system will be used to study Hmg1 gene regulation in transgenic tobacco. The potato Hmg1 promoter (Hmg1p) was isolated, confirmed by sequence analysis, and fused to the GUS reporter gene in the plant expression/transformation vector pBI101. *E. coli* was then transformed with the construct. The plasmid construction was verified by digestion and gel electrophoresis of the plasmid DNA. The Hmg1p:GUS construct was then moved into *Agrobacterium tumefaciens*, a bacterium that facilitates gene transfer into plant cells. A tobacco hairy root transient assay was performed to confirm that the promoter was correctly linked to the reporter gene. Areas of blue color were observed on the root tips after the addition of the GUS substrate, X-gluc, indicating that the GUS gene was being transcribed and translated. Fifteen tobacco explants were then infected by the *A. tumefaciens* in order to generate transformed tobacco plants. The resulting shoots will be grown up and then wounded to assess the ability of the Hmg1 promoter to direct rapid gene activation.

NATURAL & BIOLOGICAL SCIENCES CATEGORY

42. Infrageneric concepts in the genus *Crepidotus* (Fr.) Staude

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Department of Biology

Crepidotus (Agaricales) consists of small, saprophytic fungi, with a pleurotoid habit. Several conflicting infrageneric classifications have been proposed. Using nuclear large subunit ribosomal DNA sequences, phylogenetic relationships between 35 morphologically diverse species of *Crepidotus* were analyzed in conjunction with other generic representatives of the Crepidotaceae. None of the previously proposed classification systems reflect the relationships found in this study. Morphological characters traditionally applied for infrageneric classification appear to be homoplastic. Less commonly emphasized characters that may be indicative of monophyletic clades will be discussed.

43. Molecular and Evolutionary Analysis of Juan, a Non-LTR Retrotransposon in the Mosquito

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Department of Biochemistry

The Juan element is a Non-Long Terminal Repeat Retrotransposon that was first discovered in the *Aedes aegypti* and *Culex pipiens* mosquitoes (Mouches et al., 1992). Their research suggests recent amplification of the Juan element in *Aedes* and *Culex pipiens* mosquitoes and horizontal transfer as a possible mechanism of introduction. This research is focused on analyzing the evolutionary relationship of Juan elements in different species of mosquitoes and testing the hypothesis of horizontal transfer. A PCR method has been used to amplify a portion of the Juan sequence. Degenerate oligonucleotide primers were designed from a conserved region of Juan among *A. aegypti* and *C. pipiens* that includes a portion of the 5' end of the Reverse Transcriptase domain. Using these primers, PCR products of the expected size have been amplified from the genomic DNA of *Aedes aegypti*, *Aedes atropalpus*, *Aedes albopictus*, *Culex tarsalis*, *Culex quinquefasciatus*, *Anopheles gambiae*, and *Anopheles stephensi*. So far, sequences of cloned PCR fragments from *Aedes aegypti* and *Culex tarsalis* indicate the presence of two families of the Juan element that originated before the divergence of *Aedes* and *Culex* mosquitoes. This offers a unique opportunity to compare the evolution of two homologous retrotransposons in the mosquito genome.

44. Impact of Soil Nutrient Heterogeneity on Competitive Outcomes of Early Successional Plant Communities

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To test a hypothesis that nutrient foraging behavior influences competition, we grew six early successional species in monoculture and mixed species field plots with soil nutrients arranged homogeneously or in fine scale patches. In monoculture, two species, *Chamaecrista nictitans* and *Solidago altissima*, were precise foragers, having significantly ($p < 0.10$) more roots in nutrient rich than in homogeneous patches. A companion greenhouse study showed two additional species, *Pinus taeda* and *Liquidambar styraciflua*, are also precise foragers ($p < 0.05$). The root precision gradient from most to least precise was: *S. altissima*, *L. styraciflua*, *P. taeda*, and *C. nictitans*. In species mixtures, we detected two instances, *S. altissima* (*P. taeda* competitor) and *P. taeda* (*Erechtites hieracifolia* competitor), where the more precise forager was a stronger competitor in the heterogeneous treatment, with significantly ($p < 0.05$) larger biomass in nutrient patch than in homogeneous treatments. In a six species mixture, Goldberg's Index of community change, based upon relative yield in monoculture and field plots, indicated that plant competition changed with respect to nutrient treatment. It appears that: (1) precise species become stronger competitors when soils have fine-scale nutrient heterogeneity; and (2) this property may influence community structure over time.

45. Within-Site Selection of Artificial Cavity Trees by Red-Cockaded Woodpeckers

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Red-cockaded woodpeckers (*Picoides borealis*) are unique in that they excavate cavities in mature living pine trees. This unique feature, however, is thought to limit populations because of the difficulty of cavity excavation and the shortage of trees suitable for excavation. In order to compensate for these limits, artificial cavities often are constructed to increase the number of cavities available to red-cockaded woodpeckers. On Eglin Air Force Base, FL, entire artificial cavity clusters are drilled in previously unoccupied sites in order to facilitate population growth by increasing the number of breeding groups in the population. In order to improve the effectiveness of cavity drilling as a management technique, managers need to better understand what factors are influencing whether an artificial cavity becomes active. We examined several artificial cavity tree characteristics to determine how they relate to use of artificial cavity trees within active clusters on Eglin Air Force Base, FL. Data from 16 active clusters that contained both active and inactive artificial cavity trees during the 1999 breeding season were analyzed using a matched-pairs logistic regression. We found no significant difference between active and inactive trees within artificial cavity clusters for any variables measured. The data suggest that red-cockaded woodpeckers may not be selecting between trees based on the variables evaluated.

46. Water Quality in the North Fork Shenandoah River during the Drought of 1999: implications for minimum instream flow

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Department of Fisheries and Wildlife Sciences and U.S.G.S. Water Resources Division

The North Fork Shenandoah River represents 40% of the mainstem discharge but has received 60% of the area's growth. Management needs for the North Fork include 1) developing reliable tools for assessing instream flow needs, 2) relating population dynamics of smallmouth bass and other fishes to habitat variability and 3) including land-use and water withdrawal effects on instream water quality and quantity. To identify research needs, the U.S. Geological Survey conducted an investigation of water quality during a severe low flow in July, 1999. Of 52 sites studied, 11% failed to meet Virginia water quality standards for maximum temperature, 35% were near the upper thermal limits for smallmouth bass and 25% exceeded the state standards for pH. Dissolved oxygen fluctuated greatly at most sites with 37% of the sites falling below the minimum standard of 4 mg/L. Study results imply that during severe low flows, physical habitat must be considered in combination with water quality to determine usable habitat for fishes. There exists a need to quantify the duration of exposure to stressful water quality conditions and examine the contribution of water withdrawal and land-use practices to naturally limiting conditions during low flows. How low the river can go depends on knowledge of associations between biologic metrics and habitat/water quality changes for given discharges, as well as allowable withdrawals and land-use.

47. Vitamin B6 Decreases Proliferation and DNA Synthesis of Human Breast Cancer Cells In Vitro

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Department of Human Nutrition, Foods and Exercise

The growth of many breast cancers is stimulated by the action of the hormone estrogen. Hormonal therapy used to treat these breast cancers acts by interfering with the action of estrogen. Current treatments, such as tamoxifen, are not consistently useful due to development of resistance to these drugs. Tamoxifen treatment can also stimulate the development of other gynecological cancers, therefore the discovery of novel treatment options for breast cancer is critical. Vitamin B6 (B6) is well documented in its role as a modulator of steroid hormones. Pyridoxal phosphate, the active vitamer of B6, may interfere with the action of the estrogen receptor (ER) by blocking the hormone- and/or the DNA-binding site of the ER. The objective of this study was to examine the effects of B6 on proliferation and estrogen-dependent gene expression in breast cancer cells. To accomplish this, estrogen-dependent (MCF-7 and T-47D) and -independent (BT-20) breast cancer cells were supplemented with 0, 100, or 300 μM pyridoxal (PL) in the absence or presence of 0.01 μM estradiol. Cell counts and [3H]-thymidine incorporation were assessed along with Northern analysis of pS2, an estrogen-induced gene found in MCF-7 cells. PL supplementation was found to significantly decrease total cell numbers and DNA synthesis in both the estrogen-dependent and -independent breast cancer cells, without altering the expression of pS2. These results indicate that PL significantly impairs growth of breast cancer cells and may be exerting its effects via steroid-independent mechanisms.

50. Protein-Serine/Threonine Kinase Activity of a Membrane Protein from the Archaeon *Sulfolobus solfataricus*

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Department of Biochemistry

The extreme acidothermophilic archaeon, *Sulfolobus solfataricus*, exhibits a membrane-associated protein kinase activity. Solubilization of the kinase activity requires the presence of detergent such as Triton X-100 or octyl glucoside, indicating its activity reside in an integral membrane protein. This protein kinase utilizes purine nucleotides ATP, ADP, GTP, and GDP as phosphoryl donors with a requirement for a divalent metal ion cofactor, favoring Mn²⁺. A preference for NTPs over NDPs and for adenylyl nucleotides over the analogous guanylyl nucleotides was observed. The enzyme is a glycoprotein that displays catalytic activity on SDS-PAGE corresponding to a molecular mass of » 67 kDa, as well as an apparent molecular mass of » 125 kDa on a gel filtration column. Three proteins: casein, reduced carboxyamidomethylated and maleylated lysozyme (RCM lysozyme), and histone H-4 proved to be effective exogenous substrates for the protein kinase in vitro. MLCK peptide, designed after the phosphorylation site of myosin light chains, was phosphorylated by the protein kinase as well with a dramatic increase in phosphorylation observed in the presence of poly-anionic species and at elevated temperature. When the phosphoacceptor threonine in the peptide was substituted with serine an appreciable decrease in phosphorylation was noted. The protein kinase underwent autophosphorylation on threonine and was relatively insensitive to several known "eukaryotic" protein kinase inhibitors. Phosphoamino acid analysis of ³²P labeled casein, RCM lysozyme, and MLCK peptide indicated that the site of phosphorylation was on threonine, while the same analysis of histone H-4 identified ³²P-Thr in addition to ³²P-Ser. Funded by a NSF fellowship to KMB and NIH grant R01 GM55067 to PJK.

51. Denitrification in sediments of headwater streams

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We investigated the role of microbial genetic potential and seasonal variations in resource availability as determinants of denitrification in sediments of two headwater streams in the southern Appalachian Mountains, USA. We hypothesized that seasonal differences in nitrate availability and labile organic carbon influence both the potential denitrification rate and genetic denitrification potential in stream sediments. Denitrification rates were determined seasonally via in vitro incubations of stream sediments at ambient stream temperatures using the acetylene inhibition technique. In autumn and spring, we studied the effects of resource availability on denitrification using nitrate and labile organic carbon amendments. Preliminary most-probable-number (MPN) estimates indicated that there are greater than 2.7x10⁵ nitrate reducing bacteria per gram of dry sediment in each stream. No significant differences in population sizes were detected between streams. Probable denitrifiers were isolated and differentiated from other microbial populations in these MPN cultures using rep-PCR genomic fingerprinting, resulting in the detection of greater than 10 distinctly different denitrifiers from each stream. To quantify differences in the genetic potential for denitrification between streams, microbial DNA was extracted from the sediment and denitrifiers were enumerated using quantitative, competitive PCR and probe hybridization methods specific to dissimilatory nitrite reductase genes.

52. Creating Sulfide Hazard Rating Maps to Minimize Environmental Impacts of Roadbuilding Activities in Virginia

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Department of Crop and Soil Environmental Sciences

Sulfidic deposits are found in various geologic and geomorphic settings across the state of Virginia. In many of these settings, road construction has resulted in localized acid rock drainage (ARD) problems of varying severity. Due to the broad occurrence of sulfidic materials, and their variable natures, future road planning must consider two factors to minimize the effects of ARD. First, boundaries of potential ARD deposits intersecting planned highway corridors must be delineated. Second, the potential ARD severity in problem areas must be predicted to determine optimal handling and treatment procedures. The first objective of this study is to create a state-wide sulfide-hazard rating map, based on the state geologic map. This map will be generated from a compilation of documented sulfide occurrences, verbal correspondence with state mapping geologists, and field and laboratory studies. Potential ARD severity of the samples is being characterized initially by hydrogen peroxide potential acidity determinations, and by analysis of water samples from drainage ditches and local surface waters. The second objective of this study is to develop a technique for generating large-scale depth-to-sulfide maps in the Coastal Plain based on well-log data and landscape modelling. The maps presented in this poster session are examples of the customized maps that will be generated from the GI developed for this project to assist with planning of highway corridors.

53. True Amplitude Correction of Ground Penetrating Radar Data Using DC Resistivity

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Department of Geological Sciences

The goal of this project is to derive accurate reflection coefficients from Ground Penetrating Radar (GPR) data. The rapid amplitude decay with depth of the GPR signal is caused by the electrical conductivity of the material being imaged. Effective conductivity values can be estimated by fitting decay envelopes to the GPR data sets after correction for spherical divergence. Effective electrical conductivity is measured by the Direct Current Resistivity (DCR) technique. The effective conductivities may be different for each technique due to frequency effects (DC vs. MHz), spatial resolution, material anisotropy and an assumption of 1-D structure. DCR has the potential to provide sufficient spatial resolution to better correct for GPR attenuation. The mathematical relationship between the data sets is used to calculate GPR amplitude correction factors directly from the conductivity structure found with the DCR surveys. Coincident GPR and DCR surveys were acquired to compare the conductivities from each technique. Since attenuation is frequency dependent in GPR, several different source frequency signals are used to determine correction factors for multiple frequencies. The corrected data will then contain information about the true reflection coefficients. GPR reflection coefficients are due mainly to changes in the dielectric constant. The first order factors responsible for changes in dielectric constants are changes in porosity and changes in water saturation. This process is being applied to data collected in sediments, weathering zones, sedimentary and crystalline rocks. This non-invasively acquired porosity information has multiple applications in groundwater and environmental problems.

56. Mechanism of AlamarBlue Reduction in Cytotoxicity and Cell Proliferation Assays

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AlamarBlue (AB), a fluorogenic compound, is used to assess cell proliferation and cell-mediated cytotoxicity in various mammalian and bacterial cells. Because the AB assay offers the advantages of technical simplicity, freedom from radioisotopes and reproducibility and sensitivity, it is now the method of choice for assessing cellular phenomena. However, the mechanism(s) of such reduction by cellular activity has not been elucidated. We found that superoxide radicals (O₂⁻), generated by xanthine oxidase (X.O.) acting on xanthine, were able to reduce AB and this reduction was found to be susceptible to inhibition by superoxide dismutase (SOD) at pH 6.0, as well as at pH 7.0. The rate of reduction of AB by xanthine + X.O., and sensitivity of this reduction to inhibition by SOD, were both pH-dependent. The iron-chelator desferoxamine (10⁻⁴M), hydroxyl radical scavenger mannitol (6 mM), and catalase (1000 units), all had trivial effects on the rate of AB reduction. EPR spectroscopy in combination with spin trapping techniques, using the X.O. system in the presence of DMSO to generate O₂⁻ and DMPO as a spin trapping agent, was used to monitor the O₂⁻ scavenging ability of AB. In this assay, AB was found to inhibit DMPO-O₂⁻ adduct formation in a dose-dependent manner. These data clearly demonstrate that AB is a potent scavenger of O₂⁻ and assays utilizing AB, to assess metabolic activity of cells, may actually be monitoring the intracellular production of O₂⁻.

57. Limits on Invasion of Upland Hardwood Tree Species into Pine-Dominated Landscape

R.H. Jones and J. Riley*

Department of Biology

The coastal plain of the southeastern United States has undergone a cycle of cultivation followed by re-establishment of pines and small-seeded hardwoods. To determine why large-seeded tree species are slow to re-invade, we planted seeds and seedlings of five species into two environments: pine plantation understory, and clearcut. Emergence rates of planted seeds averaged 30% for three larger-seeded species (*Carya glabra*, *C. pallida*, and *Quercus alba*), but only 6% for two smaller-seeded species (*Cornus florida*, and *Nyssa sylvatica*). The large-seeded species also had significantly greater 2-yr survival after emerging, and survival was significantly greater in the understory than in the open. Direct seedling produced very short (< 15 cm tall) trees, even after two growing seasons. For planted seedlings, one-year survival was significantly greater in the understory (overall mean of 67.4%) than in clearcuts (43.5%) for each of four species tested. In both environments, the order of survival from greatest to least was *Q. alba*, *Cornus florida*, *Carya glabra*, and *C. pallida*. These early results of a long-term project suggest that the strongest limiting factors for re-invasion are seed dispersal, and in some species, poor success for individual seeds once they reach the forest. Underplanting with seedlings is apparently a viable strategy for restoring large-seeded hardwood species to pine-dominated landscapes.

62. Spectral Differentiability Between Three Pine Species

J.A.N. van Aardt* and R.H. Wynne

Department of Forestry

Spectroradiometer data (350 – 2500 nm) were acquired over various forest sites in Appomattox Buckingham State Forest Virginia, USA, to assess spectral differentiability among three major pine species, loblolly (*Pinus taeda*), Virginia (*Pinus virginiana*) and shortleaf (*Pinus echinata*) pine. Nadir only (<15°) data were collected over the tree canopies between 10h00 and 15h00 Eastern daylight time using a 50-foot boom truck. The data were then pre-processed to obtain the first and second difference of the spectra, as these represent the shape of the reflectance curves as opposed to the raw curves showing reflectance magnitude. A stepwise discriminant procedure was used to decrease the number of independent variables to the variables that maximize between group variability and minimize within group variability. The original 2150 independent wavelength variables were reduced to between 5 and 20 variables for each of the data sets. Canonical discriminant analysis and a normal discriminant analysis were performed on the data sets to test group and species separability. The hardwood and pine groups were shown to be very separable. The three pines were also shown to be separable by both of these procedures, although cross-validation results indicated the degree of separation is not as high as was originally expected. Spectral separability between three hardwood species, scarlet oak (*Quercus coccinea*), white oak (*Quercus alba*) and yellow poplar (*Liriodendron tulipifera*), showed more promise. The results of this study indicate that hyperspectral remotely sensed data may be used effectively in the spectral discrimination of these species.

63. Expression Strategies for Plant-Based Production of a Vaccine

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Department of Plant Pathology and Weed Science

Today's development of novel vaccines stresses the importance of the need for edible vaccines that are inexpensive, easily administered and capable of being stored and transported without refrigeration. Without these characteristics, developing countries find it difficult to adopt vaccination as the central strategy for preventing their most devastating diseases. A promising approach to inexpensive and effective vaccines is the production of them in plants we commonly consume. Two major obstacles have been encountered in developing vaccines in plants. First the expression level of foreign antigens tends to be low and second, coexpression of an adjuvant may be required to facilitate an appropriate immune response. Ricin, a plant toxin that survives the human digestive processes, has been proven to stimulate an immune response and could therefore serve as a suitable adjuvant. The overall goal of the research is to compare the expression levels of ricin in transgenic tobacco under the control of different promoters. The future aim is to express ricin as an adjuvant for a suitable vaccine against amebiasis.

PHYSICAL SCIENCES & ENGINEERING CATEGORY

65. CO₂ and BF₃ Adsorption on Cr₂O₃ (1012): Probing Surface Basicity and Oxygen Anions
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Department of Chemical Engineering

Acid/Base characterizations of metal oxide surfaces are often used to explain their catalytic behavior. The base properties of well-characterized Cr₂O₃ (1012) single crystal surfaces are investigated by the interactions between probe molecules and well-defined surface features. The non-polar Cr₂O₃ (1012) surface contains five-coordinate Cr³⁺ cations and three-coordinate O²⁻ anions. Surface cations may be capped with terminal chromyl oxygen (Cr=O) or Cl adatoms. The adsorption of CO₂, a standard acidic probe molecule for characterizing the basicity of oxide surfaces, is studied. CO₂ is not usually a direct probe of surface basicity (oxygen anions). CO₂ forms a bidentate carbonate on the nearly-stoichiometric surface by probing surface cation/anion site pairs. CO₂ does interact directly, however, with terminal chromyl oxygen to form a monodentate carbonate species. BF₃, while not a standard probe molecule, has been tested as a probe of the surface basicity of oxygen anions. The boron atom of BF₃ has an empty p_z-orbital, which is perpendicular to the molecular plane and has a strong tendency to accept electron pairs. BF₃ clearly probes differences in oxide ions of different coordination on Cr₂O₃ (1012). Heats of adsorption of BF₃ show that singly-coordinated terminal chromyl oxide anions are stronger Lewis bases than 3-coordinate oxygen anions on the nearly-stoichiometric surface. Heats of adsorption of CO₂ and BF₃ show opposite trends for characterizing the apparent basicity of stoichiometric and chromyl oxygen-terminated surfaces. Differences in coordination of the carbonate species formed from CO₂ adsorption make the heats of adsorption of CO₂ a poor measure of the basicity of surface oxide ions.

74. Inductor-less Piezoelectric Transformer Ballast Circuit

R.L. Lin*, F.C. Lee, E.M. Baker, and D.Y. Chen

Department of Electrical and Computer Engineering

A cost-effective inductor-less piezoelectric transformer ballast circuit has been developed without dependence on any magnetic devices. The circuit is based on a radial-mode piezoelectric transformer or Transoner® which is a product of Face Electronics, USA. Early predictions estimate that radiated electromagnetic interference is greatly reduced due to the elimination of all magnetics. In this innovative circuit, one radial vibration mode piezoelectric transformer is able to replace the inductor and the capacitors in the resonant tank portion of conventional electronic ballast circuits effectively reducing the component number and cost. This ballast circuit was tested utilizing a standard 110-volt 60-Hz line as the voltage source and a 4-foot 40-watt linear fluorescent lamp as a load. Sustained output during testing was in excess of 32 watts. Since the switches of the ballast circuit work in a ZVS (Zero Voltage Switching) condition, the turn-on switching losses can be significantly reduced over a hard-switching topology. In addition, the input capacitance of the Transoner® enhances circuit operation serving as a turn-off snubber for the half-bridge switches. This decreases turn-off voltage spiking thus reducing the turn-off losses for the half-bridge switches of the proposed circuit. Through these innovative circuit techniques, the proposed circuit provided the 32-watt power level at a commendable efficiency of around 90%. Furthermore, the low-profile design of the Transoner® can minimize the total circuit packaging size of smaller lamp fixtures, possibly yielding additional cost reduction.

75. Effects of Processing Parameters on the Microstructure of Mechanically Alloyed Polymer-Polymer Micro-Composites

J.P. Martin* and R.G. Kander

Department of Materials Science and Engineering

This work investigates the microstructure of mechanically alloyed polymer-polymer composites. Mechanical alloying (MA) offers a solid state method for creating micro-composites consisting of finely dispersed polymeric phases. The micro-composite can then be post-processed by several methods, including selective laser sintering and injection molding. By varying the charge ratio, milling time, and temperature of the MA process, the phase domain size of the resulting composite powder can be manipulated, and the physical and mechanical properties of the composite altered. In this work, micro-composites of two "high performance" polymeric materials, Poly(ether ether ketone) (PEEK) and Langley Research Center Thermoplastic Polyimide (LaRC-TPI), were produced via mechanical alloying in a vibratory ball mill at cryogenic and ambient temperatures. The resulting microstructural evolution due to mechanical alloying of these polymer-polymer composites is investigated using scanning electron and transmission electron microscopy. In this ongoing study, the phase domain sizes of the resulting micro-composite powders are quantified using image analysis techniques. Previous studies have qualitatively shown that mechanically alloying polymers could result in sub-micron size phase domains. However, this is the first study in which the phase domain sizes have been quantified and correlated to MA processing conditions for a polymer-polymer system. The phase domains present in cryogenically mechanically alloyed PEEK and LaRC-TPI composite powders have been observed to range from 10 to 180 nanometers.

76. Application of the Finite Element Method to the Seismic Design and Behavior Analysis of Large Moment End-Plate Connections

T.W. Mays*

Department of Civil and Environmental Engineering

Current building codes and regulations recognize that most buildings will incur some damage when excited by ground motion from a moderate to large earthquake. As a result, design practice provides special seismic detailing throughout the structure to ensure that when the building is shaken at the foundation, it does not collapse nor cause serious concern for life safety. When properly designed and controlled, the damaged parts of the building actually act together as a force-reducing mechanism by dissipating energy put into the building by the earthquake. Studies have shown that this type of behavior can effectively reduce forces in the building by a factor of eight or more in some cases. The force reduction is primarily due to a material property called ductility. Ductile materials, such as steel, will bend significantly without breaking. Most people have experienced ductile behavior at some time in their lives by bending a paper clip back and forth. This research uses the finite element method to model a particular type of steel connection called a moment end-plate connection. Highly-detailed local models of these connections are considered under damaging forces to better understand how the connections will respond to earthquake-induced forces. Using the results from the local models, the global response of multi-story buildings under earthquake excitation is considered. The results of this dissertation provide practical insight and seismic design guidelines for moment end-plate connections. Some of these findings are already being incorporated into current building codes.

77. Active Control of Separated Flow over a Circular-arc Airfoil

S. Miranda*

Department of Engineering Science and Mechanics

An experimental study of active control of fully separated flow was performed over a symmetrical circular-arc airfoil at high angles of attack. The experiments were conducted in a low-speed, open circuit wind tunnel at angles of attack ranging from 10 to 40 degrees. A low-power input unsteady excitation was applied to the leading or trailing edge shear layers. The actuation was provided by the periodic oscillation of a 4 percent chord flap placed on the suction side of the airfoil and facing the sharp edge. The airfoil vortex-shedding frequencies were measured and harmonic combinations selected as the applied actuator frequencies. Pressure measurements over the airfoil show that the control increased the normal force coefficient by up to 40%. This supports the idea of a vortex capture in the time-averaged sense, enhancing the lift on the airfoil by managing the shear layer roll up. Fluid flow visualization was performed to help understand the phenomena. The results of this work indicate the viability of the control of large-scale flow fields by exploiting the natural amplification of disturbances triggered by small-scale actuators. The application of flow control on sharp edged airplanes could reflect as improved maneuverability, innovative flight control and weight reduction, all this achieved by cheap, low-power rugged actuators.

78. Flexible Pavement Instrumentation at the Virginia Tech Smart Road

W. Nassar*

Department of Civil Engineering

Twelve different flexible pavement designs have been included in the Smart Road. Seven of these sections will be constructed on a fill, while five will be constructed in a cut. Those sections to be constructed in a cut are in the All Weather area. These 12 sections are instrumented with over 500 load and environmental sensors. The Smart Road project provides an excellent opportunity to test various hypotheses on pavement performance and material characteristics and combinations. The information that can be learned from the Smart Road will be an important part of the national attempt to model pavement performance. The potential benefits are many. Some include the evaluation of the performance and durability of Superpave™ mixes; collection of important data for the calibration of existing mechanistic pavement design procedures; development of accurate pavement performance prediction models; correlation of in-situ material response to properties measured in the laboratory; monitoring of different pavement designs over a long period of time; and evaluation of pavements under "All Weather Conditions." An important unique characteristic of this project is that all pavement sensors will be embedded during construction. Virginia Tech pavement instrumentation efforts in selecting, calibrating, and installing these sensors at the Smart Road project will be presented. Initial results and sensor response will also be presented.

79. Structural Characterization of Microphase Separated Poly(urethane-urea)s

M.J. O'Sickey* and G.L. Wilkes

Department of Chemical Engineering

A series of poly(urethane-urea)s films fabricated from poly(propylene glycol) (PPG), diphenylmethane diisocyanate (MDI), and an 80:20 mixture of ethylene diamine (EDA) and propylene diamine (PDA) were cast from dimethyl acetamide (DMAc). These materials were investigated in terms of microphase separation characteristics, morphology, dynamic mechanical properties and thermal transition properties in an effort to characterize the structural state of the materials. The poly(propylene glycol) used for soft segment material, was of lower monol content, narrower molecular weight distribution, and higher average molecular weight than has been previously investigated. Three soft segment (PPG) molecular weights (2000, 4000, and 8000 g/mol) were used in order to investigate the effect of soft segment molecular weight on morphology and microphase separation characteristics. Additionally two levels of hard segment content (6.3 wt% and 9.0 wt%) were also investigated. These structure characteristics were characterized with small angle x-ray scattering (SAXS), atomic force microscopy (AFM), dynamic mechanical analysis (DMA), and differential scanning calorimetry (DSC).

82. Improving the Efficiency and Life-time of Organic Conjugated Solar Cells by Using Acceptor/Donor Couples and Introducing Encapsulation

R. Schroeder*, W. Graupner
Department of Physics

Conjugated molecules are characterized by an alternating sequence of single and double carbon-carbon bonds. The use of organic conjugated molecules for solar cell applications has several advantages. Cheap and flexible materials improve the performance/price ratio, allow the cells to adapt to complex surfaces and reduce susceptibility to mechanical shock. The high intrinsic absorption coefficients of conjugated organic molecules allow the use of very thin layers for efficient electrical power generation. The electronic tunability of these molecules helps in achieving a perfect overlap of their absorption spectrum with the emission spectrum of the sun. On this poster we present methods on how to improve the two major shortcomings, life time and efficiency. By choosing suitable electron accepting and donating materials, recombination effects can be minimized and the charge carrier generation rate per photon increases while the charge transport is improved. Encapsulation by a simple process based on epoxy layers protects conjugated molecules from photo-oxidation. The materials have to be chosen carefully not to interact with the active organic layer. The experiments presented here result in an external power conversion efficiency that is increased by a factor of five and increased in life time by a factor greater than thirty compared to the basic devices.

83. Formative Evaluation of Visual Programming Environments for Teacher Creation of Educational Simulations

C. Seals*
Department of Computer Science

Today's main use of computers in the K-12 classroom is mainly for drill and practice, but studies have shown that students learn more effectively from educational simulations. We have performed studies with area science teachers. These studies will provide requirements for a new visual programming environment that will support programming by the teacher community, and provide a framework for reuse, while mitigating the problems identified in the studied systems. The rationale for building simulations as educational material is very practical. As Kuyper argues, simulations are independent of time and place, which makes them more readily available for real experience. Simulations can also provide better conceptual model of a situation, and can be used to create virtual environments, taking learning into the realm of imagination. The emphasis on reuse is tied to the need for teachers to benefit from one another's work. The current systems that we have explored have some low-level components that can be reused. We would like to explore the reuse of higher-level components, e.g. entire simulations. Finally we want a system that will support an on-line teacher community. Our initial plan is to support reuse of simulations and their components at various levels.

84. Structural Optimization using Cellular Automata

D. Slotta*

Department of Computer Science

Traditional methods of doing structural optimization are time consuming and do not parallelize well. This poster will discuss the application of cellular automata techniques for structural optimization; they also allow a simple method of problem definition and a trivial parallel decomposition. There are two sets of rules used for this technique, one used to propagate stresses and strains, and the other to perform design analysis. Both of these rules are not applied at every generation, and the choice of when to apply the rules affects the stability of the computation. When performing a Jacobi iteration over the cells the computation is slow and inefficient, but more stable, while using a Gauss--Seidel iteration the method is less stable, but faster and more efficient for those cases that converge correctly.

SOCIAL SCIENCES & HUMANITIES CATEGORY

85. Spirituality as a Dimension of Coping with Childhood Chronic Illness

C.A. Boeving* and J.W. Finney
Department of Psychology

Coping with the consequences of childhood chronic illness is a vital area of investigation for pediatric professionals. Different coping strategies, along with the child's proficiency in utilizing chosen strategies, have varied outcomes on the child's psychosocial adjustment. The psychological and medical communities are challenged to discern the most adaptive coping mechanisms for chronically ill children. The construct of coping is theoretically related to quality of life via the facilitation of well-being in various domains of functioning. Very recent published data with adult populations have begun to suggest that spirituality impacts psychological and physical health in terms of illness prevention and recovery. However, there is a relative dearth of research on spiritual factors in childhood coping. The proposed model adds the dimension of spiritual coping, which includes efforts made by the child to make sense of the problem and gain greater order in his/her world view. Spiritual coping includes religious beliefs and activities ; however, less structured strategies (e.g., meditative relaxation, communing with nature), fall into the domain of spiritual coping as well. A measure of spiritual coping was created as a modular component of the Pediatric Quality of Life Inventory (PedsQLä; Varni, J.W., Seid, M., Rode, C.A., 1999). The Spiritual Coping Module has four theoretically driven factors: purpose/place in the world, practice, care by a higher power, and connection to a higher power. These factors fall within two dimensions: existential and religious coping, both subsumed under the domain of spirituality. The one-page assessment instrument contains 21 items rated on a four-point scale to assess how often the child utilizes the coping strategy. The module was developed for use with children age eight to fourteen with corresponding parent proxy reports. The Spirituality Module is currently being piloted in a project that is examining coping and psychological outcomes (including quality of life) in a childhood cancer population. Subjects are being actively recruited at three sites (Kansas City Children's Mercy Hospital, Duke Medical Center, and Roanoke Carilion Community Hospital) for participation in the protocol.

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

F. Browser*

Department of Psychology

Research has found that the prevalence of community violence exposure is relatively high among suburban and urban middle school-aged children. Exposure through witnessing and victimization has been related to antisocial behavior. Active coping has been related to fewer emotional and behavioral problems, whereas avoidant coping is related to conduct disorder. This study will assess the effects of community violence exposure on antisocial behavior problems (in terms of school infractions) and coping as a moderator of negative effects of violence exposure. Approximately 350 ninth grade male and female students from Christiansburg High School will be recruited and grouped according to self-reports of community violence exposure and coping strategies. School misbehavior will be measured through school discipline records. A 2 (high vs. low violence exposure group) x 2 (active vs. avoidant coping group) MANOVA will be used to test for main effects and interaction of violence exposure and coping. It is expected that 1) there will be a main effect for community violence exposure such that children with high levels of violence exposure (either victim or witness) will exhibit greater school misbehavior problems than those with low levels of exposure; 2) there will be a main effect for coping such that children who use predominantly active coping strategies will exhibit fewer school misbehavior problems than those who use predominantly avoidant coping strategies; 3) there will be an interaction effect such that children with high levels of violence exposure and who also use predominantly avoidant coping strategies will exhibit the greatest level of school misbehavior problems relative to all other groups.

87. PTSD Symptoms, Depression, and Coping Predict Number of Health Complaints

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Department of Psychology

People often encounter stressful events during their lives, and many of us have faced a situation in which we believed our lives, or the life of another, to be in danger. Various studies indicate that between 67% and 90% of college students report experiencing traumatic events, depending upon how trauma was defined. Negative psychological responses to traumatic events have been associated with increased health complaints and illness among victims as well as increased health care utilization. This study sought to replicate and extend current knowledge about the relationship between traumatic events, reactions to the event, and health complaints. Further, coping strategies were evaluated for their effect on the relationship between experiencing a traumatic event and subsequent health complaints. The finding that psychological responses to traumatic events are better predictors of health complaints than number or type of traumatic events experienced was replicated. Specifically, regression analyses indicated that symptoms of depression and posttraumatic stress disorder accounted for 48.7% ($p < .001$) of the variance in the number of health complaints whereas number of traumatic events experienced accounted for only 4.9% of the variance. Moreover, number of traumatic events experienced was non-significant when psychological responses were included in the analysis. In addition, higher use of support-seeking coping strategies was related to increased health complaints ($R^2 = .176$, $p < .001$), suggesting a possible explanation for the previously reported link between psychological trauma responses and health care utilization.

88. Evaluation and Development of Maternity Garments

J. Clevenger*, T. Robinson*, and V. Giddings
Department of Near Environments

Through the researchers' own experiences with maternity garments, they became aware that problems existed in the areas of fit, price, style, and availability. Limited research has been conducted on maternity apparel. Of these studies, only one focused on the wearer's preferences. Pregnant women are an important consumer market, and designers, manufacturers, and retailers need to be aware of the problems that pregnant women have with maternity clothing and their apparel preferences. The researchers conducted a study that evaluated the satisfaction and dissatisfaction of the availability, style, cost, selection, and fabrics of maternity garments. Additionally, problem areas of maternity garments and the needs and preferences of the respondents were identified. Thirty women who were currently pregnant or had been pregnant in the last four years completed a questionnaire. The majority of respondents were dissatisfied with the availability and selection of maternity clothing. Almost half were dissatisfied with the cost of maternity clothing. While the majority was satisfied with fit, they were not satisfied with the style of maternity garments. Half of the respondents were dissatisfied with the fabrics currently used. The majority of the respondents experienced problems with fit. Based on the survey results and suggestions made by respondents, the researchers developed a garment line that included a short sleeve top, a long sleeved top, shorts, pants, and a dress. The line was developed using black and white 100% cotton woven pique. Interviews were conducted with several respondents who indicated that the garments fulfilled their expectations of a maternity garment.

89. Four-Month-Old Infants Prefer Slower Rates Of Speaking

J. Cooper*

Department of Psychology

Even for a pre-linguistic infant, speech is an important method of communication between parent and child. Parents use speech in their everyday interactions with infants, for example, to sooth them when upset and arouse them for interaction. Many studies have sought to ascertain what characteristics of infant-directed (ID) speech are important in such interactions. The present study focused on how rate of speaking affects infant attention. Eighteen 4-month-old infants were tested in a procedure where a visual display (concentric circles) was paired with ID speech at an extremely slow rate (ID-slow) or ID speech at a faster, more normal rate (ID-normal). All infants received at least five trials of each display-speech type pairing. Infants looked significantly longer at the visual display when it was paired with ID-slow speech ($M = 20.88$, $SD = 9.30$; $F(1, 17) = 5.590$, $p < .05$) than when it was paired with ID-normal speech ($M = 16.36$, $SD = 7.94$). These are the first known results to establish the importance of speaking rate in 4-month-old infants' attention to speech. Given the role of parental speech in early developmental processes such as infant emotion regulation and language development, the implications of the current finding are far reaching. Slower speech may calm infant physiological systems, enabling them to better focus on tasks such as parental interaction and instruction. In addition, slower rates of speaking may make adult utterances easier for infants to parse into sounds that can be babbled and imitated.

90. Effects of Cardiovascular Reactivity and Negative Affect on the Attributions of Hostile Men to Proactive or Neutral Partner Behavior

K.A. Cosenzo*

Department of Psychology

This study investigated the roles of negative affect and cardiovascular reactivity on the attributional responding of hostile males. College males were screened with the Cook-Medley Hostility Scale (Cook & Medley, 1954). High and low hostile males were assigned to an arousal inducing (serial subtraction by 7's) or a non-arousal inducing condition (serial subtraction by 1's). Cardiovascular reactivity and self-report of affect were measured to the serial subtraction task. After the task was completed, the participant listened to a vignette (provocative or neutral) which depicted an interpersonal situation. The participant answered questions about the scene to assess attributional responding. The arousal-inducing condition was associated with significantly greater changes in systolic and diastolic blood pressure and heart rate and a higher level of self-reported negative affect than the non-arousal inducing condition. More negative attributions were reported for provocative than neutral scenes. Males in the arousal inducing condition made more negative attributions to neutral scenes than males in the non-arousal condition. There was no significant effect of arousal condition on the negative attributions to provocative scenes. Hostility did not influence the relationship between arousal condition and self-reported affect or arousal condition and attributional responding. This study showed that inducing cardiovascular reactivity prior to a neutral encounter with a partner can affect the males' perception of the potentially neutral encounter.

91. Globalization and Urban Structure in Latin America; the case of export processing zones in El Salvador

C.E. Ferrufino*

Department of Urban Affairs and Planning

This research explores the relationship between economic transformations, as part of the process of globalization of the economy in Latin America and the restructuring of urban space. The study reviews two main bodies of the literature. The first one, concerned with the economic evolution of the region in the last two decades, the second related with the changes in the urbanization process. Drawing from these sources, a new model of the urban structure of Latin American cities is introduced. The empirical part of the research focuses in the case of San Salvador, El Salvador, particularly in the study of the relationship between the establishment of new Export Processing Zones (EPZs) and the emergence of new massive residential developments occurring next to them, thirty kilometers away from the city. A randomized household survey was conducted in two sites in order to get information about the processes of spatial displacement of these populations and their hypothetical direct connection with the EPZs, and contrast these results with the theoretical assumptions of the model. There is no evidence of strong direct connections between the neighborhoods and the EPZs. However, there is significant evidence that these linkages occur at a regional level, since the corridors where export oriented industries have tended to concentrate appear to be increasingly connected to the metropolitan dynamic, as suppliers of work force and potential areas for new development. Therefore, economic globalization appears to act as a catalyst of a new pattern of urbanization, with profound social, administrative, and environmental consequences.

92. College Women's Perceptions and Expressions of Anger

K. Flemke*

Department of Human Development, Marriage and Family Therapy

The role of gender intersects the subject of anger with many specific messages from both macro and micro levels. Historically, women have been socialized not to express anger, as femininity was believed to be contingent upon certain temperaments and displays of behaviors. As society continues to evolve, messages regarding "appropriate" expressions of anger for women continue to be sent. These messages are often transmitted intergenerationally, individually interpreted, and then acted upon within social interactions and relationships. A goal of this research project is to expand awareness of how women who experience expressions of anger are impacted, both personally, and within their relationships. Therefore, focus groups with college women will be used to understand how messages from one's culture and family shape women's experiences of expressing anger.

93. Modeling Host Community Residents' Attitudes Toward Tourism Using LISREL

D. Gursoy*

Department of Hospitality and Tourism Management

The objective of this research was to model host community support for tourism development based on the factors that are found to influence the host community's reaction towards tourism development. Drawing from current literature and theory in the area, a tourism support model with a series of hypotheses involving 15 paths was proposed. Using data collected from five counties surrounding the Mt. Rogers National Recreation Area the proposed model and the hypothesized paths were tested by using the LISREL 8 structural equation analysis package with maximum likelihood (ML) method of estimation, in combination with the two-stage process. The findings of this study revealed that the host community support for tourism development is affected by six factors and the host community support for tourism development can be modeled by using those factors. These factors are the level of community concern of local residents, the level of ecocentric values of local residents, the perceived state of the local economy, utilization of tourism resource base by local residents, the perceived cost and the perceived benefits of the tourism development.

94. Forces Driving Change in Food Consumption Pattern in Quick Service Segment in Restaurant Industry

S.P. Hahm*

Department of Hospitality and Tourism Management

During the past two decades there have been significant changes in U.S. food consumption patterns. Consumers are purchasing smaller quantities of beverage milks, eggs, pork and beef and are consuming more poultry, fish, fruits and vegetables, and drinks. The most significant trend in food consumption behavior has been the shift away from animal products. These changing consumption patterns might be driven by many reasons. First, the purchasing decisions of consumers are the end result of complex interactions among economic, sociocultural and psychological factors. For example, some of the previous studies view the change in food demand as a response to variations in the demographic and socioeconomic composition (Smallwood, Blaylock, and Blisard, 1992). Second, the change of taste can be affected by different factors. In this regard, lifestyle and noneconomic factors may play an important role in the consumption pattern of many other food products. One of the important factors is the consumer health concern over blood cholesterol level and saturated fat intake. Potential consumption change in food demand is an important issue because such changes may require corresponding changes in marketing and production strategies for the food service industry. In this study an investigation is made regarding forces driving change in consumer food preference and changing trends of food consumption pattern and how these changes have influenced the Quick Service segment in restaurant industry.

95. Development, Reliability and Validity of the Beliefs toward Mental Illness Scale

M. Hirai* and G.A. Clum
Department of Psychology

The present study describes the development of a new scale to measure Beliefs toward Mental Illness (BMI), which was designed to measure cross-cultural differences in such beliefs as well as to predict treatment-seeking behavior among different cultural groups. A total of 216 students participated in this study (114 Asian students and 102 American students). Construct validity was examined by a series of exploratory factor analysis. Identified factors include beliefs that mentally-ill people are dangerous, that mentally-ill people have poor social and interpersonal skills, and that mental illness is incurable, and one factor whose items had little face validity which was eliminated from the final solution. Moderate to high reliability estimates of the BMI, with comparable results in both the Asian and American groups were obtained. Significant item-total correlations for each factor were also demonstrated. Several significant correlations between treatment preferences and BMI subscales were shown, and group differences in the patterns of correlations existed. One-way ANOVAs revealed that Asian students are more likely to think that people suffering from psychological disorder are dangerous and poor at social and interpersonal relationships, and no difference between groups was found on the incurability factor. Hierarchical regression analyses revealed that cultural differences between American and Asian students were predicted by their beliefs that mentally-ill people are dangerous and have deficits in social and interpersonal skills after controlling for demographic differences due to significant demographic differences.

96. A Qualitative Approach to Attitudes, Beliefs, and Understandings of Hormone Replacement Therapy

M. Housenick*
Department of Teaching and Learning

The objective for this qualitative research study is to explore the reasons why some women choose to participate in hormone replacement therapy (HRT) while others do not, even when it is clinically advisable to participate. This study seeks to answer two questions: 1) What are the attitudes, beliefs, and understandings of postmenopausal women regarding HRT and 2) How do these attitudes, beliefs, and understandings influence their decision of whether or not they should begin HRT. The methodology includes in-depth, semi-structured interviews with postmenopausal women identified through purposeful sampling. Each participant answered a series of standardized open-ended questions regarding their attitudes, beliefs, and understandings of HRT. By taking a qualitative approach, I became the primary data collection instrument whose efforts may result in findings that are rich in description bringing forth the choices of the women who shared their time and thoughts with me. The data analysis consists of reviewing transcripts, recordings, and field notes to identify themes and too assist in triangulation of the data. Preliminary results of this study suggest that the women have received some level of HRT counseling, but that the information they receive is limited and at times confusing. They appeared to base their decisions on this limited information combined with their beliefs and attitudes that they held in regards to the health benefits of HRT.

97. Spatial Social Networks

C.A. Johnson* and R.P. Gilles
Department of Economics

We introduce a spatial cost topology in the network formation model analyzed by Jackson and Wolinsky, *Journal of Economic Theory* 71 (1996), 44--74. This cost topology might represent geographical, social, or individual differences. It describes variable costs of establishing social network connections. Participants form links based on a cost-benefit analysis. We examine the pairwise stable networks within this spatial environment. Incentives vary enough to show a rich pattern of emerging behavior. We also investigate the subgame perfect implementation of pairwise stable and efficient networks. We construct a multistage extensive form game that describes the formation of links in our spatial environment. Finally, we identify the conditions under which the subgame perfect Nash equilibria of these network formation games are stable.

98. Evolution of Conventions in Endogenous Social Networks

C. Johnson*, E. Droste, and R.P. Gilles
Department of Economics

We analyze the dynamic implications of learning in a large population coordination game where both the actions of the players and the communication network evolve over time. Cost considerations of social interaction are incorporated by considering a circular model with endogenous neighborhoods, meaning that the locations of the players are fixed but players can create their own communication network. The dynamic process describing medium-run behavior is shown to converge to an absorbing state, which may be characterized by coexistence of conventions. In the long run, when mistake probabilities are small but non-vanishing, coexistence of conventions is no longer sustainable as the risk-dominant convention becomes the unique stochastically stable state.

99. Computer Adaptive Testing with the MBTI: An Investigation of Measurement Precision

K.D. Keller* and R.J. Harvey
Department of Psychology

Computer adaptive versions of the Introversion-Extroversion, Sensing-Intuition, Thinking-Feeling, and Judging-Perceiving scales of the Myers-Briggs Type Indicator (MBTI; Briggs & Myers, 1976) were simulated using responses from a sample of 10,775 MBTI profiles and item response theory techniques. Employing this approach, the potential benefits of computer adaptive testing (CAT) with the MBTI were investigated using data obtained from paper and pencil measures. Results indicated that CAT afforded a substantial improvement in terms of measurement precision when viewed relative to previous paper and pencil short forms. On average, across the instrument's four dimensions, a 90% standard error stopping criteria resulted in a substantial 42% decrease in the number of items administered. Results are discussed in terms of the potential benefits associated with the use of computer adaptive personality measures. Additional psychometric issues relating to the specific use of computer adaptive versions of the MBTI are explored.

100. Appraisal of Control and Coping Strategy Utilization Following a Traumatic Stressor in Youth: Relationships to Depressive Symptomatology

C. Kephart*, A.K. Langley, R.T. Jones, and T.H. Ollendick
Department of Psychology

Children's coping strategies have become important targets of investigation, as coping has been found to play a critical role in children's adjustment to a stressor. Appraisal has been examined more recently inasmuch as the interaction between coping strategies employed and appraisal of a stressful event has been hypothesized to help further explain children's responses to a stressful event. In this study, 81 children who had experienced a residential fire were asked to indicate what coping strategies they employed after the fire as well as their appraisals of control at the time of the fire. Results indicate a significant interaction effect, $F(1, 78) = 4.638, p = .034$, such that a mismatch between appraisal of control and coping strategy predicted elevated levels of depressive symptomatology. Depressive symptomatology was highest when children who perceived the fire as uncontrollable used problem-focused copings strategies, or strategies intended to act on the stressor. Conversely, children who reported a mismatch such that they perceived the fire as controllable but used emotion-focused strategies, or strategies intended to regulate emotional states, also reported elevated levels of depressive symptomatology. The results of this study support previous research and suggest that the relationship between coping and psychological outcome is more complex than previously thought.

101. A Comparison of Variables Influencing Consumers' Store Patronage between South Korea and the United States: Suggestions for the Marketing Strategy of South Korean Discount Stores

S. Kim* and J. Chen-Yu
Department of Near Environment

Since 1997, the retailing industry of South Korea has suffered a decline in sales due to the nation's financial crisis. Because of the increase of South Korean consumers' economic consciousness, the net sales of discount stores have been drastically increasing. Many foreign discount companies started participating in the South Korean market, but they experienced some difficulties in understanding South Korean consumers. The purpose of this study was to compare the U.S. and South Korean consumers' store patronage and examine the relationships between five variables (i.e., shopping orientation, importance of store and product attributes, store evaluation, satisfaction/dissatisfaction, demographics) and their store patronage. In addition, South Korean consumers' preference towards the attributes of the U.S. discount store was examined to determine whether these attributes could be adapted to South Korean discount stores. A model was developed as the framework of the study based on the previous research. Data were collected with a questionnaire from a total of 234 participants inside Wal-Mart, 117 from South Korea and 117 from the U.S. The proposed model of this study is successful to understand South Korean customers' shopping behavior, as most projected relationships in the hypotheses are significant in South Korea, but not in the U.S. This study provides insights in the understanding of discount store customers in South Korea and gives specific suggestions for marketing strategies.

102. Implications of Matthew's Story Pamela

M. Lloyd*

Department of Teaching and Learning

This project presents a variety of methods for expanding and developing the reading and communication skills of high school special needs students. These methods were developed and tested during an action research project conducted at a high school in which special needs students are integrated into general education classes. As an instructional assistant, part of my job was to develop meaningful and relevant experiences to enhance one particular student's language and communication skills. This student, whom I call Matthew (a pseudonym), is a 19 year old with Down Syndrome. By engaging Matthew in various processes related to writing and reading that led to the creation of his own book, he was provided with a variety of opportunities for expression. These processes included word study utilizing kinesthetic activities as well as word cards which provided the student with a self-made word bank from which to create phrases and sentences. The book also served as a means for the student to connect and communicate with people in his environment. Over time, the artifacts of this project (including videotaped lessons and conversations, and the student's written work) provided evidence that Matthew had improved his inclination to use multiple literacy tools for expression as well as to interact with people in his environment. My poster presentation will include examples of the artifacts from this project as well as a display of the methods and results developed in the context of my work with Matthew.

103. A Meta-Analysis of Serotonin 5-HIAA and Antisocial Behavior

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Over the past 25 years researchers have examined the relationship between biochemical variables and antisocial behavior in human adults, but none has been studied more intensely than the serotonin metabolite 5-hydroxyindoleacetic acid (5-HIAA). A major goal of the current study was to employ meta-analytic procedures to quantitatively evaluate the relationship between 5-HIAA concentrations and antisocial behavior. This study aimed to support the hypothesis that antisocial groups would show reduced cerebrospinal fluid (CSF) 5-HIAA levels compared to non-antisocial groups. It also aimed to assess the effects of moderating variables in influencing the relationship between 5-HIAA and antisociality. Using PsycINFO, MEDLINE, SSCI and Dissertation Abstracts, a search was conducted of empirical studies related to serotonin and antisocial behavior. Using strict inclusion criteria 18 CSF 5-HIAA reports were identified. Results showed that the mean effect size ($M = -.43$) significantly differed from 0.00 in the direction of lowered serotonin in the antisocial groups. The homogeneity statistic ($Q=203.605, p<.001$), however, indicated variability of effect sizes across studies and categorical models were tested to explore this variability. Results showed a significant moderating effect for gender ($Q_b=10.915, p<.001$), indicating that groups comprised of only antisocial men exhibited larger negative effect sizes than groups comprised of antisocial men and women. Results did not show moderating effects for target of violence, history of suicide, and alcoholism. The effects for gender suggest that serotonin may act differently on female violence, and the fact that effects did not differ based on other moderating variables lends support to the relationship between reduced serotonin 5-HIAA and antisocial behavior regardless of type of crime or psychiatric problems.

104. GIS Model for Park Siting Analysis

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Department of Civil Engineering

Critical county data such as geography and water sources are needed for urban planning. GIS mapping techniques like Arcview and ARCINFO are used to identify the ideal location for a park. Color-coded computer coverages of soil type, population density, land value, and total area are overlaid to find the ideal regions for a park. Land suitable for agriculture, with high population density, or within three-fourths of a mile from a major highway is omitted from the map after the overlay function. A buffer of 0.5 miles is applied and the proximity function is used so that any land greater than a half mile away from a stream is deleted. Weights are assigned for population density and land value to build a rank ordering of the available park sites. At the end of the project, a map is created that lists the top areas to site a park in the county. The best site for a park is in an area of low population density, minimal land value, and no agricultural soils. GIS mapping techniques like this one could be used to plan business, recreation, health care facilities, or any other needs of the public. Designing models to produce maps with geographic location linked to data is a powerful tool for environmental planning. GIS models reduce the negative ramifications of urban sprawl by giving communities and individuals the ability to see the bigger picture through layers in a map.

105. Consumer Attitudes Towards Imported Apparel: A Descriptive Study of Four Urban Communities

B. Ruth*, S. Burr, K. Carroll, and D. Kincade

Department of Near Environments

Human rights violations in sweatshops that supply the US with imported apparel are receiving attention in the media. Consumers now possess a greater awareness of working conditions in Third World economies due to a few high profile cases of alleged human rights abuses. In this study, 79 consumers responded to a questionnaire that was developed from both the research model of beliefs, attitudes, and behaviors (Fishbein & Ajzen, 1975), and current affairs articles. A group of independents pilot tested the questionnaire, which, with 10 point scales, assessed consumers' beliefs, attitudes and resultant purchasing decisions regarding imported apparel. A convenience sample of respondents from four urban areas, who represented a range of ages, incomes, and ethnic diversity, was used. A majority had a favorable attitude towards apparel production in Third World countries, but not towards substandard conditions. They believed that using labor in these countries supported economic development. The majority of respondents would purchase a garment made in a Third World country, but not in poor working conditions. Working conditions in which a garment was made was more important than garment price and style. The majority of participants looked at labels before purchasing, but did not make purchase decisions based on country of origin, nor did they look for the Made in the USA label, or feel that products from domestic production were preferable to imported products. This study identifies attitudes towards imported apparel, helps determine the effect of country of origin labels on consumers, and adds to the academic literature about clothing purchasing decisions.

106. The Impact of Divorce on the Adjustment of Children and Adolescents in China

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Divorce and its impact on children's adjustment have been actively studied in the United States, in which there is a high divorce rate (over 45% in 1996). A considerable consensus in the research literature indicates that children in divorced families, on average, show more problems than those in nondivorced families. Compared to the United States, there is a relatively low divorce rate in China (15% in 1993). However, the number has been rising in recent years. While little research has been conducted on divorce and its impact in China, many concerns have been raised about children's adjustment following their parents' divorce. This study was one of the first research attempts to address this issue. One hundred and seventy-four children (4th to 9th graders) from divorced families and 174 children (4th to 9th graders) from intact families participated in the study. Questionnaires were given to the children, their parents, and their teachers to assess the children's self-concept, emotional well-being, behavior problems, peer relationships, and academic achievements. Parents also filled out measures on depression, parenting behavior, and demographic information. MANOVA analyses using 3 factors (divorce vs. intact, age, and gender) revealed significant group differences on the majority of the measures. In addition, regression analyses indicated that gender of the child, family income, years since divorce, parent's depression, and parenting style were significant predictors of children's post-divorce adjustment. Cultural influences on divorced parents and their children were discussed.

107. Goals and Alcohol Use in College Students: an Integrated Motivational Approach

C.D. Williams* and R.S. Stephens

Department of Psychology

Despite risk for negative consequences, many college students drink to excess. Binge drinking among college students is associated with increased instances of verbal confrontations, physical fights, unprotected sex, vandalism, driving while under the influence, etc... Both outcome expectancies and alcohol self-efficacy are social cognitive theory constructs that show consistent but modest predictive utility in alcohol studies. Another social cognitive variability that may influence drinking is goals. Personal projects (Little, 1983) are self-elicited statements of personal goals rated on relevant attributes (e.g., involvement, difficulty). The present study examined the ability of personal project attributes to explain variance in heavy consumption. In a cross-sectional sample of 200 college students, path analysis tested the theoretical model that goal attributes would predict alcohol efficacy, and that the triad of goal attributes, alcohol efficacy, and alcohol expectancies would each display direct effects on drinking. Results indicated self-efficacy was the strongest predictor of alcohol consumption ($b = -.39$; $p < .01$), followed by goal involvement ($b = -.24$; $p < .01$) and negative drinking expectancies ($b = -.12$; $p < .05$). Positive drinking expectancies ($b = -.38$; $p < .01$) and global goal efficacy ($b = .16$; $p < .05$) were significant determinants of alcohol efficacy. The complete model explained 36% of the variance in heavy episodic drinking. The unique and indirect contributions of goal involvement are major findings of the study, supporting the viability of a motive driven ecological approach within the broader social cognitive examination of drinking.

108. Cerebral asymmetry in the dual-task performances of high-hostile males

J. Williamson*

Department of Psychology

The influence of level of hostility on the cerebral hemispheric regulation of cardiovascular system functioning and fluency of 24 high-hostile and 24 low-hostile males was examined. The Ruff Figural Fluency Test (RFFT) was used as a measure of nonverbal fluency and as an indicator of right frontal functioning. The Controlled Oral Word Association Test (COWAT) was used as a measure of verbal fluency and as an indicator of left frontal functioning. Additionally, systolic and diastolic blood pressure, and heart rate were assessed via a digital blood pressure meter. High-hostile males displayed more interference than low-hostile males on the right frontal tasks of sympathetic nervous system regulation and nonverbal fluency. Specifically, high-hostile males evidenced increased systolic blood pressure subsequent to the completion of the nonverbal fluency test, whereas low-hostile males did not show any increase in blood pressure upon completion of the nonverbal fluency test. Further, high-hostile males committed significantly more perseverative errors on the nonverbal fluency test than low-hostile males. These results were predicted, and suggest differential right frontal lobe capacity between low- and high-hostile males. The present findings are also consistent with our previous findings among high-hostile adults. Ecologically, this right frontal capacity difference may help account for the increased risk of cardiovascular disease evidenced with the presence of hostility. Additionally, this research may lead to dual-task recommendations for the reduction up sympathetic nervous system response in high-hostile males.

VIRTUAL CATEGORY

109. Navigation/Way-Finding: A Comparative of the Real versus Simulated World Holly Cline

J.Xu*

Department of Near Environments, EDP Program

<http://caus5.arch.vt.edu/jun/virtual/index.htm>

The purpose of this project is twofold. The first purpose is to conduct a review of relevant literature pertaining to navigation in virtual environments and the second purpose is to conduct an exploratory study comparing navigation/way-finding techniques in an immersive VR space with real space. The framework used for this model will be visual representation of design by simulation, which will distinguish how the respondents are experiencing the defined spaces. The exploratory study will be used to uncover concepts and ideas related to the comparison of virtual space to real space. Two groups of university students will navigate/way-find through space. One group will navigate/ way-find through virtual space and one group will navigate/way-find through real space. The project's main goal is to establish a need for research in this area and to establish questions for further research.