

Polytechnic Institute and State University



Annual 20th Research Symposium

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The 20th Annual Research Symposium of Virginia Polytechnic and State University

The Graduate Student Assembly (GSA) is proud to host this symposium in order to provide graduate and advance graduate students an opportunity to showcase their achievements in research and stimulate interactions with other students and faculty.

This book is a compilation of the abstracts submitted by this year's participants.

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Graduate Student Assembly
309 Squires Student Center
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Total=77 Abstracts

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N.E McKeown*, M. Fenaux, P.G. Halbur, X.J. Meng
Department of Biomedical Sciences and Pathobiology

2. Characterization and analyses of the complete genomic sequence of avian hepatitis E virus (avian HEV)

F.F.Huang*, Z.F.Sun, F. W. Pierson, T. E. Toth, and X. J. Meng
Department of Biomedical Sciences and Pathobiology, College of Veterinary Medicine

3. Effects of Endosulfan and Permethrin Exposure on Apoptotic and Necrotic Cell Death of Murine Splenocytes, In Vitro.

Vimala Vemireddi*1 and Hara P Misra1, 2;
1 Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech, Blacksburg, VA; 2 Edward Via Virginia College of Osteopathic Medicine, Blacksburg, VA USA.

4. The effects of zineb and endosulfan on MPTP-induced striatum dopamine depletion in mice

Zhenquan Jia*1 and Hara P Misra1, 2
1Department of Biomedical Sciences and Pathobiology
2Edward Via Virginia College of Osteopathic Medicine

5. Characterization of the SARS Coronavirus Nucleocapsid Protein: Identification of Common Antigenic Epitope(s) with Animal Coronaviruses and Implication for SARS Diagnosis

Z. F. Sun* and X. J. Meng
Center for Molecular Medicine and Infectious Diseases, Department of Biomedical Sciences and Pathobiology, College of Veterinary Medicine

5.5. Generation and Infectivity Titration of an Infectious Stock of Avian Hepatitis E Virus (Avian HEV) in Chickens and Cross-species Infection of Turkeys with Avian HEV (not for competitive evaluation)

Z. F. Sun*, C. T. Larsen, F. F. Huang, P. Billam, F. W. Pierson, T. E. Toth and X. J. Meng
Center for Molecular Medicine and Infectious Diseases, Department of Biomedical Sciences and Pathobiology, College of Veterinary Medicine

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P. Billam*, F. F. Huang, Z. F. Sun, D. K. Guenette, F. W. Pierson, R. B. Duncan, T. E. Toth, and X. J. Meng.
Department of Biomedical science and Pathobiology, College of Veterinary Medicine.

7. Effects of *in vivo* Exposure to Endosulfan and Permethrin on the Striatal Dopaminergic Pathways

Carolina Aguilar 1, Hara P. Misra, 1,2
1Dept. of Biomedical Sciences and Pathobiology, Virginia Tech
2Virginia College of Osteopathic Medicine, Blacksburg, VA, USA

8. Identification of a Low Molecular Weight Protein Tyrosine Phosphatase and Its Potential Substrates in *Synechocystis* Sp. PCC 6803

Archana Mukhopadhyay* and Peter J. Kennelly
Department of Biochemistry

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I.O. Ismail* and E.P. Beers
Department of Horticulture

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Phillip Wadl*; Dr. Richard Veilleux
Department of Horticulture

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Thakare Mohan*, C. R. Jangade
Department of Animal and Poultry Sciences, Virginia Tech, Blacksburg, VA, USA

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Turpyn*, Janet Walberg Rankin, Shelly Nickols-Richardson, and Mary Dean Coleman
Department of Human Nutrition, Foods, and Exercise

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Department of Biology

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T. Slotta* and D. Porter
Department of Biology

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K. Sloan* K. Pope, T. Slotta, and D. Porter
Department of Biology

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Katie Paul*, Janet L. Donahue, Timothy J. Larson
Department of Biochemistry

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Ken Hurkey*
Department of Biochemistry

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Department of Biochemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

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Department of Psychology

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L. Wan*, I. C. Christie, and H. J. Crawford
Department of Psychology

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CMMID, Department of Biomedical Sciences and Pathobiology

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S. A. Hafez1*, W.R. Huckle1, T. Caceci1, K. E. Panter2.
1DBSP, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Polytechnic Institute and State University
2ARS Poisonous Plant Research Laboratory, U.S. Department of Agriculture.

24. The Role of Threat Assessment in the Gap Analysis Framework: Applications in Aquatic Systems

Kimberly M. Mattson*, Scott D. Klopfer, and Paul L. Angermeier
Department of Fisheries and Wildlife Sciences, Virginia Tech, Blacksburg, VA 24061-0321, USA;
United States Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0321, USA.; Conservation Management Institute, 1900 Kraft Drive Suite 250, Blacksburg, VA 24061-0534, USA

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Department of Wood Science & Forest Products

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Laura M. Horsch*
Department of Psychology

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Department of Psychology

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Department of Mathematics and Department of Educational Research and Evaluation

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D.M. Ravizza¹*, O. Lee², & P.L. Burge³
¹Department of Teaching & Learning, ²University of North Carolina-Greensboro, ³Department of Educational Research

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S. Krishnakumar* & T. Cobb
Department of Management

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H. Lee* 1, J. Huh 2, and K. Park 2
1: Department of Apparel, Housing, and Resource Management
2: Department of Hospitality and Tourism Management

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Kunsoon Park*
Department of Hospitality and Tourism Management

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Melih Madanoglu * and Kyuho Lee
Department of Hospitality and Tourism Management, Virginia Tech

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Dept. of Human Development

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Department of Political Science

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Ying-Feng Pang*

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Engineering Science and Mechanics Department, Virginia Tech

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Chris Cassino*, Eric Johnson, Robert West

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Xinyu Zhang*, Arvid Myklebust

Department of Mechanical Engineering, AVID LLC

Paul Gelhausen, AVID LLC

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Theresa R. Cassino¹*, Roger Anderson³, Robert H. Sturges³, Brian J. Love², Kimberly F. Williams¹

¹ Department of Chemical Engineering, ² Department of Materials Science and Engineering, ³ Department of Mechanical Engineering

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Department of Materials Science and Engineering

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Morsi Mahmoud* and David Clark

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Bradley Department of Electrical and Computer Engineering

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Department of Electrical and Computer Engineering

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H. D. Patel* and S. K. Shukla

Department of Electrical and Computer Engineering

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Sai Sundarakrishna*
Department of Industrial and Systems Engineering

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N.H Fong*, Robert H. Sturges and John Shewchuk
Grado Department of Industrial and Systems Engineering

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PhD candidate, Civil & Environmental Engineering

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Morgan Asbury Eddy*, MS, EIT

Department of Civil and Environmental Engineering

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Jeong-Hoi Koo*

Department of Mechanical Engineering

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X. Song*

Department of Engineering Science and Mechanics

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Mechanical Engineering

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Tess Wynn*

Biological Systems Engineering

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Rachel Wagner* and Dr. Theo A. Dillaha

Biological Systems Engineerin

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Leigh-Anne Henry* and Theo A. Dillah
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Department of Computer Science

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Markus Lorch*
Department of Computer Science

Agricultural and Animal Sciences

1. Molecular characterization of porcine TT virus, an orphan virus, in pigs from 6 different countries

N.E McKeown*, M. Fenaux, P.G. Halbur, X.J. Meng
Department of Biomedical Sciences and Pathobiology

Human TT virus (TTV), originally isolated from a patient with post-transfusion hepatitis in 1997, was initially thought to be responsible for post-transfusion hepatitis. Viruses related to human TTV have since been identified in non-human primates, bovine, ovine, porcine, feline, and canine. The objective of this study was to genetically characterize porcine TTV from pigs in different geographic regions. PCR primers based on the non-coding region of the only available porcine TTV isolate were designed to amplify porcine TTV DNA from sera of pigs in 6 different countries. Porcine TTV DNA was detected in 66.2% (102/154) of the swine sera. The percentages of positive pigs varied greatly from country to country and even within the same country: 33% in Iowa, USA, 40% in Thailand, 46% in Ontario, Canada, 80% in China, 85% in Korea, 90% in Spain, 100% in Quebec and Saskatchewan, Canada. A total of 40 porcine TTV isolates (5 from each geographic region) were sequenced for a 218 bp fragment within the non-coding region. Sequence analyses revealed that porcine TTV isolates from different geographic regions shared 86-100% nucleotide sequence identity to each other. Phylogenetic analysis showed that the clustering of the porcine TTV isolates is not associated with geographic origins. Although porcine TTV is not known to be associated with any swine disease, coinfection of pigs with TTV and other known swine pathogens may result in enhanced disease. There are also concerns for risk of potential human infection during xenotransplantation.

2. Characterization and analyses of the complete genomic sequence of avian hepatitis E virus (avian HEV)

F.F.Huang*, Z.F.Sun, F. W. Pierson, T. E. Toth, and X. J. Meng
Department of Biomedical Sciences and Pathobiology, College of Veterinary Medicine

Avian hepatitis E virus (avian HEV), recently identified from a chicken with hepatitis-splenomegaly syndrome in the United States, is genetically and antigenically related to human and swine HEVs. In this study, we completed sequencing the genome of avian HEV. The full-length genome of avian HEV, excluding the poly (A) tail, is 6,654 bp in length. Similar to mammalian HEV genomes, the avian HEV genome consists of a short 5' non-coding region (NCR) followed by three partially overlapping open reading frames (ORFs), and a 3' NCR. Avian HEV shares about 50% nucleotide sequence identity in the complete genome, 48-51% identity in ORF1, 46-48% identity in ORF2, and only 29-34% identity in ORF3 with mammalian HEV strains. Significant genetic variations such as deletions and insertions, particularly in ORF1 of avian HEV, were observed. However, motifs in the putative functional domains of ORF1 such as helicase and methyltransferase are relatively conserved between avian HEV and mammalian HEVs, supporting the conclusion that avian HEV is a member of the genus *Hepevirus*. Phylogenetic analyses revealed that avian HEV represents a branch distinct from human and swine HEVs. The results from this study confirmed that avian HEV is related to, but distinct from, human and swine HEVs.

3. Effects of Endosulfan and Permethrin Exposure on Apoptotic and Necrotic Cell Death of Murine Splenocytes, In Vitro.

Vimala Vemireddi*1 and Hara P Misra1, 2;

1 Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech, Blacksburg, VA; 2 Edward Via Virginia College of Osteopathic Medicine, Blacksburg, VA USA.

The pesticides endosulfan and permethrin negatively affect the immune system in non-target organisms. We hypothesized that these pesticides cause immune suppression, at least in part, by enhanced apoptotic cell death. Splenocytes from adult C57Bl/6 male mice were exposed to endosulfan, or permethrin or mixtures of these chemicals, in vitro. Cytotoxicity was evaluated using 7-amino-actinomycin D (7-AAD) staining and DNA ladder assay. A dose- and time-dependent decrease in viability with a corresponding increase in early and late apoptosis/necrosis was seen with endosulfan exposure. Permethrin exposure resulted in neither a time- or dose-dependent loss of splenocyte viability nor induction of apoptosis in these cells. With mixtures of permethrin and endosulfan, depressed viability and enhanced early apoptosis and late apoptosis/necrosis were also observed. Visual evaluation using DNA ladder assay confirmed the contribution of both apoptotic and necrotic processes. These findings suggest that the immunotoxicity of endosulfan and permethrin is associated with the occurrence of early and late apoptotic/necrotic processes.

4. The effects of zineb and endosulfan on MPTP-induced striatum dopamine depletion in mice

Zhenquan Jia*1 and Hara P Misra1, 2

1Department of Biomedical Sciences and Pathobiology

2Edward Via Virginia College of Osteopathic Medicine

The thiocarbamate fungicides are ubiquitous environmental contaminants. These pesticides are known to enhance the depletion of striatal dopamine levels and are implicated behind the pathogenesis of Parkinsons Disease. Zineb (zinc-ethylenedisithiocarbamate) is used extensively to control unwanted plants. The organochlorine insecticide, endosulfan is a potent inhibitor of acetylcholinesterase (ACHE) and is known to adversely affect neurotransmitters. We hypothesized that these two pesticides either individually or in combination would increase MPTP (1-methyl-4-phenyl-1, 2,3,6-tetrahydropyridine)-induced neurotoxicity. Male C57Bl/6 mice (six weeks old) were exposed to zineb (50 and 100 mg/kg), endosulfan (1.55 and 3.1 mg/kg) and their mixtures every other day over a 2-weeks period. The levels of dopamine and its metabolites in striatum and the activity of ACHE in cerebral cortex were monitored by high-performance liquid chromatography (HPLC) and spectrophotometric analysis, respectively. Results of these studies showed that zineb alone, but not endosulfan, could significantly ($P<0.05$) enhance MPTP-induced striatal dopamine depletion. Preliminary data also showed that mixtures of pesticides produced more exacerbation of MPTP-induced striatal dopamine depletion than when exposed to individual pesticides. However, the activity of ACHE was not significantly affected by these treatments. These data suggest that mixtures of these pesticides enhance the depletion of the nigrostriatal dopamine system.

5. Characterization of the SARS Coronavirus Nucleocapsid Protein: Identification of Common Antigenic Epitope(s) with Animal Coronaviruses and Implication for SARS Diagnosis

Z. F. Sun* and X. J. Meng

Center for Molecular Medicine and Infectious Diseases, Department of Biomedical Sciences and Pathobiology, College of Veterinary Medicine

Severe acute respiratory syndrome (SARS) is an emerging infectious disease associated with a novel coronavirus and causing worldwide outbreaks. SARS coronavirus (SARS-CoV) is an enveloped RNA virus, which contains several structural proteins. Among these proteins, nucleocapsid (N) protein is a major structural protein. In order to develop a diagnostic assay specific for SARS, the SARS-CoV N gene was cloned, expressed in *Escherichia coli* using a pRSET-C expression vector in this study. After the isopropyl-b-D-thiogalactoside (IPTG) induction, N protein was expressed as an insoluble form and purified by BugBuster His-Bind Purification System. N protein is highly immunogenic and abundantly expressed. The purified recombinant N protein was confirmed with a monoclonal antibody against the Xpress epitope tag and with a convalescent SARS patient serum by Western blot. The antigenic cross-reactivity between the N protein of SARS-CoV and that of known animal coronaviruses was analyzed using Western blot. We found that the SARS-CoV N protein shares common antigenic epitope with that of antigenic group I animal coronaviruses but not of antigenic groups II or III, and thus raising concerns for using N protein or whole virus as antigens in serological diagnosis of SARS. The use of SARS-CoV N protein or the whole virus could lead to false positive diagnosis in patients infected by antigenic group I coronaviruses, and could also complicate the search for an animal reservoir as many animal species are infected by the antigenic group I coronaviruses.

5.5. Generation and Infectivity Titration of an Infectious Stock of Avian Hepatitis E Virus (Avian HEV) in Chickens and Cross-species Infection of Turkeys with Avian HEV (not for competitive evaluation)

Z. F. Sun*, C. T. Larsen, F. F. Huang, P. Billam, F. W. Pierson, T. E. Toth and X. J. Meng

Center for Molecular Medicine and Infectious Diseases, Department of Biomedical Sciences and Pathobiology, College of Veterinary Medicine

Avian hepatitis E virus (avian HEV), a novel virus discovered from chickens with hepatitis-splenomegaly (HS) syndrome in the United States, is genetically and antigenically related to human HEV. In order to characterize avian HEV, an infectious avian HEV stock with a known infectious titer must be generated as HEV can not be propagated in vitro. Bile and feces collected from specific-pathogen-free (SPF) chickens experimentally infected with avian HEV were used to prepare an avian HEV infectious stock as a 10% suspension of positive fecal and bile samples in PBS buffer. The infectivity titer of this infectious stock was determined by inoculating one-week old SPF chickens intravenously with 200 μ l each of the serial 10-fold dilutions (10⁻²-10⁻⁶) of the avian HEV stock (2 chickens per dilution). All chickens inoculated with 10⁻²-10⁻⁴ dilutions, 1 of the 2 chickens inoculated with 10⁻⁵ dilution, but not those two inoculated with 10⁻⁶ dilution of the infectious stock, seroconverted to avian HEV at 4 weeks postinoculation (WPI). Two un-inoculated contact control chickens housed together with the 10⁻² dilution-inoculated chickens also seroconverted at 8 WPI. Viremia and fecal virus shedding were detected variably in chickens inoculated with 10⁻²-10⁻⁵ dilutions but not in those inoculated with 10⁻⁶ dilution. The infectivity titer of the infectious avian HEV stock was determined to be 5 x 10⁵ 50% chicken infectious doses (CID₅₀) per ml. Upon the availability of this infectious virus stock, we attempted to experimentally infect turkeys with avian HEV. Eight one-week old turkeys were intravenously inoculated with 10⁵ CID₅₀ of avian HEV, and another group of 9 birds was un-inoculated as controls. The inoculated turkeys seroconverted to avian HEV at 4-8 WPI. Viremia was detected at 2-6 WPI, and fecal virus shedding at 4-7 WPI in inoculated turkeys. An un-inoculated contact control turkey housed together with the inoculated ones also became infected through direct contact. This is the first demonstration of cross-species infection by avian HEV.

6. Systematic pathogenesis and replication of a strain of the hepatitis E virus (HEV) in its natural host: avian HEV infections in specific-pathogen-free adult chickens.

P. Billam*, F. F. Huang, Z. F. Sun, D. K. Guenette, F. W. Pierson, R. B. Duncan, T. E. Toth, and X. J. Meng.
Department of Biomedical science and Pathobiology, College of Veterinary Medicine.

Hepatitis E virus (HEV) is an important human pathogen. Due to the lack of a cell culture system for HEV, little is known regarding its pathogenesis and replication. In this study, we utilized a homologous animal model system, avian HEV infection in chicken, to systematically study the replication and pathogenesis of a strain of HEV. Eighty-five 60 week old SPF chickens were divided into three groups. One group of chickens were each inoculated with 105.5 50% chicken infectious dose of avian HEV by oral route, the second group were given the same dose by i.v route and chickens in the third group were uninoculated controls. Two chickens from each group were necropsied at various days postinoculation (DPI) and a variety of samples were collected. Avian HEV antibodies were detected in inoculated chickens at about 14 DPI. Fecal virus shedding was detected from 1 to 20 DPI in i.v group, and from 7 to 35 DPI in oral group. Avian HEV RNA was also detected in serum, bile and liver samples of inoculated chickens. This study suggests that chickens could be experimentally infected with a strain of HEV via its natural route of inoculation and the data provide insights into the pathogenesis and replication of HEV under natural route of infection.

7. Effects of *in vivo* Exposure to Endosulfan and Permethrin on the Striatal Dopaminergic Pathways

Carolina Aguilar 1, Hara P. Misra,1,2
1Dept. of Biomedical Sciences and Pathobiology, Virginia Tech
2Virginia College of Osteopathic Medicine, Blacksburg, VA, USA

Several studies indicate that exposure to certain pesticides may cause degeneration of the nigrostriatal pathway leading to the development of Parkinson's disease. We studied the effects of permethrin and endosulfan on the levels of dopamine and its metabolites in the brain of mice. C57Bl/6 mice of 7-9 months old were injected, i.p., with each of the pesticides and their mixture every-other day during a two week period. Mice were sacrificed 24 hrs after the last injection. The corpora striatum was extracted and analyzed by HPLC for dopamine and its metabolites. The pesticide treatment groups exhibited no significant change in dopamine levels as compared to controls. However, there was significant increase in homovalinic acid levels in higher dose pesticide mixture-treated groups. Because reactive oxygen species have been implicated in the development of Parkinson's disease, and are known to cause degradation of certain neurotransmitters, we monitored the levels of lipid peroxides in brain cortex as an indicator of free radical tissue damage. Increased levels of lipid peroxides were observed in all brain tissues of animals exposed to these pesticides, being significant ($p < 0.05$) only in the low dose treatment groups. Western blot analysis of alpha-synuclein, a major component of Lewy bodies in neurodegenerative diseases, exhibited double bands in all pesticide treated groups indicating up-regulation. These results indicate that animals exposed to endosulfan and permethrin seem to have induced oxidative stress leading to higher levels of lipid peroxidation in the cortex and this may be responsible for the aggregation of alpha-synuclein. The non-significant change of dopamine levels may be due to compensatory mechanism(s) occurring within the striatal pathways. Therefore, we conclude that a free radical mechanism involving lipid peroxidation and alpha-synuclein aggregation may be involved in pesticide-induced pathogenesis of Parkinson's disease.

8. Identification of a Low Molecular Weight Protein Tyrosine Phosphatase and Its Potential Substrates in *Synechocystis* Sp. PCC 6803

Archana Mukhopadhyay* and Peter J. Kennelly
Department of Biochemistry

Protein phosphorylation networks are regulated by two classes of enzymes, protein kinases and protein phosphatases. The amino acid sequence of Slr0328, encoded by slr0328, in cyanobacterium *Synechocystis* sp. PCC 6803 shared the conserved active site sequence with known low molecular weight protein tyrosine phosphatases. slr0328 was amplified from genomic DNA and cloned into vectors encoding an N terminal His tag or C terminal His tag. The recombinant proteins were expressed in *E. coli*, and the phosphatase activity of each was examined toward several phosphoprotein and non-protein substrates in vitro. Slr0328 exhibited phosphatase activity toward phosphotyrosine protein substrates, however, it failed to dephosphorylate the phosphomonoester bonds of serine phosphorylated substrates. Several phosphotyrosine proteins were detected in cell extracts of *Synechocystis* sp. PCC 6803 through Western blot analysis using RC20 antibodies specific to phosphotyrosine. Among these phosphotyrosine proteins, three appeared to be potential substrates for Slr0328.

9. Towards Understanding Transcriptional Regulation of Xylem Cysteine Protease 1 in *Arabidopsis*

I.O. Ismail* and E.P. Beers
Department of Horticulture

A functional water-conducting system is required to sustain plant growth and development. In the secondary tissues of vascular plants, the differentiation of water-conducting tracheary elements (TEs) within the xylem is the result of orchestrated regulation of molecular processes culminating with programmed cell death (PCD) and cellular autolysis. TE-PCD and autolysis are probably dependent on the activity of hydrolytic enzymes such as xylem cysteine protease 1 (XCP1). Due to the lack of mutants that affect the PCD and autolytic phases of TE differentiation, XCP1 may be a valuable model for understanding the regulation of such processes. Here, we report that a 0.578 kb upstream region of XCP1 drives GUS reporter gene expression in TEs and that deletion analysis suggests that only a 313-bp region is sufficient and necessary. Further targeted deletions supported by promoter clustering predict that critical regulatory elements are present within 40 bp of this region. Based on such results, yeast one-hybrid analysis is currently carried out to identify interacting factor(s). Finally, we present our view on possible involvement of Myb and Dof proteins in regulating XCP1 expression.

10. Selection of *Fragaria vesca* Accessions to *Agrobacterium* Mediated Transformation Protocol

Phillip Wadl*; Dr. Richard Veilleux
Department of Horticulture

For the past century, efforts in agricultural research have centered on increasing crop production to feed the growing human population. Most of the gene discovery tools of functional genomics have been developed in studies of the model plant, *Arabidopsis thaliana*. *Arabidopsis*, being a cruciferous plant, has a dry fruit (silique) that is not representative of many species of horticultural importance where fleshy fruit comprise the edible product. No comprehensive genomics platform is currently under development for fruit crops, giving functional genomics studies with *F. vesca* the potential of identifying genes important in fruit crops. The goal of this present research is to identify superior accessions of the diploid species *Fragaria vesca* (wild strawberry) with respect to transformation efficiencies, in vitro growth, and phenotypic responses in a growth chamber. Ten *F. vesca* accessions were obtained from the National Clonal Germplasm Repository Corvallis, Oregon. These ten accessions were evaluated in regard to in vitro performance; *Agrobacterium*-mediated transformation efficiency, as noted by Alsheikh et al. (2002), and phenotypic performance in a growth chamber. For an accession to be deemed superior, performance requirements had to be satisfied in all three of the categories being tested.

11. Screening of indigenous medicinal plant *Zingiber officinale* for its pharmacological activities on blood pressure of anaesthetized dog.

Thakare Mohan*, C. R. Jangade
Department of Animal and Poultry Sciences, Virginia Tech, Blacksburg, VA, USA

Zingiber officinale attributed to have different therapeutic uses in Ayurveda. It was proposed to screen for pharmacological studies. The objective of this study was to evaluate the hypotensive activity of this medicinal plant. The percentage extractability of *Zingiber officinale* in solvent like water was found to be 48.3 % and in solvent like alcohol it is 25 %. On phytochemical analysis *Zingiber officinale* revealed the presence of the alkaloids and amino acids. On carotid blood pressure of anaesthetized dogs, both the extract of the *Zingiber officinale* produced hypotension at the dose rate of 4 mg/kg and 5 mg/kg of body weight for aqueous and alcoholic extract. The responses were soon regained to normal and were not blocked by atropine indicates that the muscarinic mechanism of hypotensive action is absent. The normal bracket responses of the tetrad were seen to be unaltered after administration of both the extract. From this study it is concluded that the extract of *Zingiber officinale* has hypotensive effect on carotid blood pressure of anaesthetized dog and could be useful in conditions of high blood pressure.

11.5 The Effects of a High or Low Fat Weight Loss Diet on Markers of Inflammation and Oxidative Stress in Overweight Women

Turpyn*, Janet Walberg Rankin, Shelly Nickols-Richardson, and Mary Dean Coleman
Department of Human Nutrition, Foods, and Exercise

Weight loss can reduce elevated markers of inflammation and oxidative stress observed in obese individuals. Our objective was to evaluate the effect of weight loss diet composition (Atkins high fat, HF, and low fat, LF) on inflammation and oxidative stress. Thirty two overweight women, BMI 25.4 ± 4.0 kg/m² were randomly assigned to either the HF or LF diet for 4 weeks. Body weight, markers of inflammation (serum interleukin-6, IL-6; C-reactive protein, CRP) oxidative stress (urinary 8-epi-prostaglandin F₂, 8-epi) and fasting blood glucose were measured weekly. In spite of no differences in magnitude of weight loss (4.9 ± 1.5 kg HF vs. 3.5 ± 1.8 LF, $p=0.06$), the HF diet resulted in a net increase in the cardiovascular disease risk factor, CRP, while it was reduced by the LF diet ($+54\%$ vs. -48.9% , $p=0.0004$). There was a significant effect of group with HF higher than LF ($p=0.0025$) and a trend ($p=0.058$) for an interaction of groups over time with 8-epi. For both groups, glucose decreased with weight loss ($p=0.0004$), while IL-6 increased ($p=0.03$). The LF diet was superior to the HF in reducing a key marker of inflammation, while both diets had similar effects on oxidative stress.

Natural and Biological Sciences

12. Using the land-cover cascade concept to examine the relationship between anthropogenic land-cover and stream health

C.L. Burcher* and E.F. Benfield
Department of Biology

Stream biota are important components of stream ecosystems and are widely used to assess stream health. Agriculture and residential land-uses are increasingly common disturbances decreasing stream health worldwide. Stream ecologists have demonstrated that macroinvertebrates and fish respond to changes in stream substrate composition and have inferred that stream substrate is somehow affected by land-use. However, few studies have attempted to identify the mechanisms linking land-cover change and biotic responses. Here I propose a new concept that integrates physical components of stream ecosystems along a spatiotemporal hierarchy I call the land-cover cascade (LCC). The LCC hypothesizes that land-cover disturbance induces a cascading effect whereby disturbance associated with land-cover change trickles directionally through hydrologic, geomorphic, erosional, and substrate components before ultimately affecting biota. Here we present data collected from ten streams affected by agriculture and residential disturbance. We quantified a suite of physical and biotic responses to residential and agricultural land-cover and compared them using linear regression. As expected, biotic responses were highly correlated with substrate metrics and some geomorphic metrics. Relationships among physical variables agreed with the land-cover cascade concept. The LCC appears to be useful in understanding the relationship between stream health and anthropogenic disturbance

13. Variation of GBSSI and rpl16 in the Malacothamnus Alliance (Malvaceae)

T. Slotta* and D. Porter
Department of Biology

The granule bound starch synthase (GBSSI) gene of the nuclear genome and the rpl 16 region of the chloroplast genome are examined for phylogenetic utility in the Malacothamnus Alliance. The Malacothamnus Alliance consists of three genera, Iliamna, Malacothamnus, and Phymosia. Previous analyses with the internal transcribed spacer (ITS) region and the chloroplast trnL-F region yielded inconclusive and conflicting results. The ITS region resulted in a weakly supported tree with Iliamna being polyphyletic. The trnL-F tree had fewer statistically supported clades than the ITS tree and had I. corei and I. remota in a clade with Phymosia. The GBSSI-1 region occurs in three separate loci in members of the Malacothamnus Alliance. In phylogenetic analyses of GBSSI-1, there was sufficient variation to provide statistical support of both basal and terminal branches. The genus Iliamna remains polyphyletic in a monophyletic Malacothamnus Alliance. The rpl16 region was explored to show an alternative phylogeny. With the addition of these two regions, the resulting phylogenies provide insight to the evolutionary and biogeographic histories of the alliance.

14. Assessing Genetic Diversity Among Rare Mallows Using ISSRs

K. Sloan* K. Pope, T. Slotta, and D. Porter
Department of Biology

Iliamna is a genus in the family Malvaceae that is found in North America. Two species, *Iliamna remota* and *Iliamna corei*, occur in distinct habitats but share a number of morphological traits, so there has been debate concerning whether *I. corei* should be recognized as an independent species. Both *I. remota* and *I. corei* are listed as endangered at the state level, and *I. corei* is also listed as federally endangered. We used ISSR (inter-simple sequence repeat) PCR, which amplifies genomic DNA using a primer that targets repeated regions, and yields highly reproducible DNA fingerprints. Samples from native populations and greenhouse generated hybrids were compared. We were able to detect genetic differences between the species and hybrid plants. Loci (bands) were detected with ISSR PCR that are unique to individual populations and species. Furthermore, germination rates were determined to be higher in *I. remota* and *I. corei* crosses more so than hybrid crosses with *I. rivularis*. Conclusive results identifying the relationships within these two species of *Iliamna* will be valuable in preserving the species.

15. Characterization of the ygaV-ygaP Operon of Escherichia coli

Katie Paul*, Janet L. Donahue, Timothy J. Larson
Department of Biochemistry

The genome of *Escherichia coli* is predicted to encode nine proteins with similarity to rhodanese, an enzyme that catalyzes sulfur transfer from thiosulfate to cyanide. Membrane-associated YgaP is a minor contributor of rhodanese activity compared to previously characterized rhodanases PspE and GlpE. ygaP is believed to be cotranscribed with the upstream and directly adjacent ygaV gene. ygaV is predicted to encode a metalloregulatory transcriptional repressor of the ArsR family. The goal of this work was to determine if YgaV functions as a repressor to control expression of the ygaV-ygaP operon. Understanding regulation of the ygaV-ygaP operon will provide greater understanding of the function of YgaP in cellular sulfur metabolism. Two constructs were made: 1) a chromosomal ygaV deletion, and 2) a plasmid containing a transcriptional fusion of the theorized operon promoter region to the lacZ gene, which, if transcribed, produces b-galactosidase. The ygaV-deleted strain and a wild-type strain were transformed with the plasmid containing the ygaV-lacZ fusion, and b-galactosidase levels were measured. More than 10-fold higher levels of ygaV-lacZ expression were found in the ygaV-deleted strain compared to the wild-type control, suggesting that YgaV is a negatively acting transcriptional regulator (repressor) of its own promoter. Future work is needed to verify co-transcription of ygaV and ygaP, and to identify signals affecting the activity of the YgaV repressor.

16. FT-IR Spectroscopic Studies of DNA Repair by Photolyase

Ken Hurkey*
Department of Biochemistry

When living cells are exposed to sunlight, ultraviolet light can cause damage to genetic material in organisms; errors in DNA can result in cell lethality and mutation in daughter cells. The majority of this DNA damage is in the form of cyclobutane pyrimidine dimers (CPD). The light-activated enzyme photolyase catalytically repairs CPD lesions in DNA. Understanding the mechanism of photolyase is critical for developing a method for skin cancer prevention. Although the basic steps in the photolyase-catalyzed DNA repair process are mapped, details of the mechanism are still under debate in the literature. Towards the end of examining structural changes in the enzyme and the DNA lesion upon substrate binding and repair, our overall research goal is to examine the catalytic repair process of CPDs by photolyase using FT-IR spectroscopy. We have synthesized and purified a cis-syn cyclobutane pyrimidine dimer in both 2- and 8- base oligomers to probe the DNA lesion with vibrational techniques. Difference infrared data of the CPD DNA-minus-undamaged DNA indicate strong change in the bending frequencies of the C5 methyl group, consistent with the structure of CPD. We have expressed and purified the *E. coli* photolyase enzyme and using transformation assays, UV-vis spectroscopy, and immunoblotting, shown that the enzyme is active and repairs the model substrates. The Difference FT-IR spectra of photorepair demonstrate that we observe vibrational modes from residues in photolyase that participate in restoring monomer pyrimidines in nucleic acids.

17. Genetic and Biochemical Analysis of *Bacillus subtilis* Sulfurtransferases

Randall V. Mauldin*, Jeremy P. Hunt, Janet L. Donahue, Timothy J. Larson
Department of Biochemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

Bacillus subtilis contains four predicted sulfurtransferases with a rhodanese homology domain. These proteins are YtwF, YrkF, YqhL, and YbfQ. Rhodanese is an enzyme that catalyzes the transfer of sulfur from thiosulfate to cyanide forming thiocyanate and sulfite. By using a strain of *B. subtilis* with an insertion mutation in ytwF we were able to determine the rhodanese activity for the enzyme in crude extract. The results indicate that YtwF is responsible for approximately 80% of the rhodanese activity in the late log phase cell. To further identify the roles of rhodanases in *B. subtilis*, insertion mutations in yqhL and yrkF were also constructed. From the single mutants, a series of double mutants and a triple mutant were constructed. To determine if the rhodanases are needed for biosynthesis of sulfur containing cofactors such as thiamin, molybdopterin, biotin, and lipoic acid, the single, double, and triple mutant strains were plated on minimal media with either ammonium sulfate or potassium nitrate as the nitrogen source. All of the mutants grew on the minimal media, indicating that none of the sulfurtransferases is specifically required for biosynthesis of these cofactors.

18. Comorbid Psychological Distress and Marijuana Use Before and After Treatment: Testing Cognitive-Behavioral Hypotheses

Josie DeMarce*, Robert S. Stephens, and, Roger Roffman
Psychology

Marijuana is one of the most frequently used illicit drugs in the United States (Hall, Johnston, and Donnelly, 1999) and a significant portion of marijuana dependent adults who seek treatment have clinically elevated levels of psychological distress (Stephens, Roffman, and Simpson, 1993). Further, after treatment negative emotional states were the most frequently cited reason for relapse to marijuana use (Stephens, Curtin, Simpson, and Roffman, 1994). This presentation examines the relationship between psychological distress and marijuana use in negative affect situations both before and after treatment. Participants were 291 adults seeking treatment for their marijuana use who were randomly assigned to a cognitive behavioral relapse prevention therapy, a brief individualized assessment and advice motivational intervention, or a delayed treatment control condition. Psychologically distressed participants reported lower situational self-efficacy for resisting marijuana use in psychologically distressing situations compared to non-psychologically distressed participants ($p < .01$). Contrary to the prediction, both psychologically distressed ($p < .01$) and non-psychologically distressed ($p < .01$) groups had higher situational self-efficacy for psychologically distressing situations when compared to non-psychologically distressing situations. The findings have implications for situation specific coping liabilities, treatment of comorbid drug users, and related theory.

19. Alexia without Agraphia: Connecting the Disconnection

Gina A. Mollet*, Robert P. Walters, David W. Harrison, Ph.D
Department of Psychology

Alexia without agraphia is an acquired anatomical disconnection syndrome where the ability to write is intact, but the ability to read is lost. Dejerine (1892) was the first to describe the anatomical basis of the disorder. Traditional alexia without agraphia usually is the result of a disconnection between visual information in the occipital lobes and Wernicke's area in the left temporal lobe. The syndrome arises from a disconnection between the occipital regions of both cerebral hemispheres and the angular gyrus of the left cerebral hemisphere. The angular gyrus must be functionally intact but devoid of visual input from the occipital lobes for the disorder to appear. The present research establishes the existence of an atypical lesion within the visual projections producing alexia without agraphia but without the traditional cognitive deficits that occur with the classic syndrome.

The current paper describes two cases of alexia without agraphia: one occurring after infarction of the left cerebral artery and the other the result of a retinopathy. The first patient, J.J., is a 61-year-old male with the classic lesion causing the syndrome. The second patient is a 55-year-old male who acquired alexia without agraphia after a retinopathy.

20. Synchronization Between Prefrontal, Midfrontal and Parietal Cortex Immediately Prior to Accurate and Inaccurate Decision-Making Responses.

Justin Loe*, Helen Crawford, PhD, & Don DuRousseau
Psychology

EEG theta coherence increases as demands increase during working memory tasks, as evidenced by long-range coherence between the prefrontal/mid-frontal and parietal regions (e.g., Molle et al., 2002; Sarnthein et al., 1998; Weiss et al., 2000). This study compared EEG theta (5-7 Hz) coherence one second prior to making decisions in a 2 1/2 hr. computer-based, decision-making task. Participants were 4 right-handed, healthy adults. Continuous EEG was recorded from 29 sites, referenced to the mastoid. Comparison of mid-frontal (Fz) and mid-parietal (Pz) sites found significantly more coherence prior to inaccurate than accurate responses (respectively, .444 and .417; $F = 23.94$, $p = .02$) for the first 100 trials. Hemispheric differences for prefrontal-parietal connections were observed. In the left hemisphere, Fp1-P3 coherence was significantly higher prior to inaccurate than accurate responses (respectively, .138 and .120, $F = 9.17$, $p = .05$), whereas in the right hemisphere there was no difference (respectively, .155 and .146; $F = .23$). These results suggest that working memory during complex decision-making involves synchronization between prefrontal/frontal and posterior association cortex by theta brain activity.

21. Hostility, Anxiety, and Cardiovascular Reactivity in a Healthy Female Community Sample: Risk Factors in the Etiology of Cardiovascular Disease

L. Wan*, I. C. Christie, and H. J. Crawford
Department of Psychology

Hostile and anxious coping styles have been implicated in the etiology of cardiovascular disease. A possible mechanism by which these coping styles are translated into increased risk is through persistently magnified cardiovascular reactivity to stressors. Increased activity of the sympathetic branch (SMP) of the autonomic nervous system has traditionally been implicated in increased reactivity, though recent models have implicated decreased activity in the parasympathetic branch (PSMP). The present study investigated mean heart period (HP) and indices of variability in HP indicative of SMP and PSMP responding. A community sample of 177 healthy women (aged 21-50 years) was evaluated during rest, baseline, stressor, and recovery conditions. Anxiety and hostility were assessed using the Taylor Manifest Anxiety Scale and the Cook-Medley Hostility Scale. Four groups were created using median splits of the two scales. Across groups, HP and PSMP were significantly lower during the stressor than all other conditions. In the high-anxious, but not low-anxious, group PSMP failed to return to pre-stressor levels during recovery and SMP was significantly greater during rest. Results support the proposition that PSMP plays an important role in the etiology of cardiovascular disease and suggest a greater focus on pre- and post-stressor periods may be warranted.

22. Genomic and Phenotypic Analyses of the AI-2 Quorum Sensing System among Members of the Pasteurellaceae

Shivakumara Siddaramappa* and Thomas Inzana
CMMID, Department of Biomedical Sciences and Pathobiology

Quorum sensing (QS) is a mechanism of interbacterial communication that has been shown to be involved in the regulation of virulence in pathogenic bacteria. We sought to identify the furanosyl borate diester (AI-2) mediated QS system among members of the Pasteurellaceae. Using BLAST analysis, we identified several of the genetic components (*metK*, *pfs*, and *luxP/Q/R/S*) of the pathway involved in the biosynthesis of and response to AI-2 in the genomes of *Haemophilus somni* (*Histophilus somni*), *Haemophilus influenzae*, *Mannheimia haemolytica*, and *Actinobacillus pleuropneumoniae*. Using the *Vibrio harveyi* BB170 luminescence-based reporter assay, we tested culture supernatants from these species for the presence of AI-2 signal. The assay was performed in dark, 96-well plates in quadruplicates and luminescence was measured every hour for 6-8 hours using a scintillation-luminescence counter. By this simplified assay we were able to detect AI-2 production in *H. influenzae*, *H. parasuis*, *A. pleuropneumoniae*, and *M. haemolytica*. However, luminescence induction by culture supernatants from these species had a characteristic quantitative variability. Culture supernatants from *H. somni* produced the least response, if any, but the *luxS* gene from this species was able to complement AI-2 biosynthesis in *E. coli* DH5a. The observed variability in luminescence induction between different bacterial species suggests that the AI-2 molecule may not be a universal signal.

23. Developmental Expression of Vascular Endothelial Growth Factor (VEGF) and Its Receptors (Flt-1 and KDR) in the Reproductive Organs of Normal and Swainsonine-treated Pregnant Goats

S. A. Hafez^{1*}, W.R. Huckle¹, T. Caceci¹, K. E. Panter².
¹IDBSP, Virginia-Maryland College of Veterinary Medicine, Virginia Polytechnic Institute and State University
²ARS Poisonous Plant Research Laboratory, U.S. Department of Agriculture.

VEGF and its receptors, fms-like tyrosine kinase (*flt-1*) and kinase-insert domain-containing receptor (KDR), are essential for both physiological and pathological angiogenesis; i.e., formation of new blood vessels from pre-existing ones. The female reproductive organs, which exhibit dynamic growth and regression accompanied by changes in the levels of factors promoting such growth, are among the few adult tissues in which periodic angiogenesis normally occurs. To learn more about the role of VEGF in mediating angiogenesis during pregnancy, we studied the sequential expression of VEGF and its receptors (*Flt-1* and *KDR*) using the real-time quantitative reverse transcription polymerase chain reaction. We collected uterine and ovarian tissues from two groups of goats: one non-pregnant and another group euthanized at 4, 7, 10, 13, 16, and 18 weeks of gestation. Expression of VEGF, *flt-1* and *KDR* mRNAs was measured using primers and TaqMan[®] probe specific for each target. Targets were detected in all the tissues studied; however, levels of expression differed according to the stage of pregnancy. As an application of our study, we tested the effect of a potential anti-cancer compound, swainsonine (active component of locoweed) on the expression of VEGF and its receptors at 7 and 18 weeks of pregnancy. There was no significant effect of swainsonine on the expression of the three targets in any of the studied tissues at 7 weeks of pregnancy, but it had an inhibitory effect at 18 weeks.

24. The Role of Threat Assessment in the Gap Analysis Framework: Applications in Aquatic Systems

Kimberly M. Mattson*, Scott D. Klopfer, and Paul L. Angermeier

Department of Fisheries and Wildlife Sciences, Virginia Tech, Blacksburg, VA 24061-0321, USA;

United States Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0321, USA.; Conservation Management Institute, 1900 Kraft Drive Suite 250, Blacksburg, VA 24061-0534, USA

Cost-effective conservation of freshwater aquatic systems requires planning at large spatial scales, the use of watershed-level frameworks, and recognition of factors that threaten biodiversity. Terrestrial Gap employs spatial analysis using land stewardship, dominant vegetation, and species distributions to assess land protection status. A key obstacle in applying Gap analysis to aquatic systems is that the use of land ownership as a surrogate for threat assessment is inadequate for identifying areas of conservation priority within streams. As part of the Upper Tennessee Aquatic Gap Analysis Project, we are using land use and hazard identification as parameters in a watershed-based threat assessment. This approach deviates from the terrestrial gap approach in two important ways. First, watersheds are affected by actions on the surrounding landscape. Second, the magnitude and frequency of occurrence of harms within watersheds is paramount in identifying areas potentially available for protection. Our modeling scheme uses a ranking approach to identify, categorize, and prioritize threats and their associated hazards. Examples of threats illustrate the ranking process within the Upper Tennessee. Preliminary results suggest that both distance to stream and the location of a hazard within a stream network are important considerations in freshwater conservation.

25. Determining Hardwood Sawmill Efficiency Factors

Patrick M. Rappold*, D. Earl Kline, Brian Bond, and Janice K. Wiedenbeck

Department of Wood Science & Forest Products

The lack of published uniform data collection techniques and analysis procedures for sawmill benchmarking makes it difficult to determine if the performance of a sawmill is at or above an acceptable (profitable) level. Within the hardwood sawmill industry there is a need for tools and training programs that will assist managers and operators in making accurate and timely planning decisions with regards to material flow and cost. The objectives of this ongoing study are to quantify the effect that raw material (e.g. species, log grade, diameter, and length) and level of processing technology has on productivity at the major processing stations (e.g. headrig, edger, trimmer, etc.) and examine how operating costs are determined as a function of productivity at the major processing stations, level of processing technology and raw material. It is also the goal of this study to develop models (cost and system simulation), which will assist the hardwood sawmill industry in optimizing and configuring raw material processing.

Social Sciences and Humanities

26. The Influence of Shyness on Affective Response to Interpersonal Evaluation

Laura M. Horsch*
Department of Psychology

Shyness is a condition that typically involves fear of evaluation and a low expectancy for social success (Phillips & Bruch, 1988). The current study investigated whether shy individuals react more negatively to the prospect of interpersonal evaluation than do non-shy individuals. A sample of 48 undergraduate students were selected for participation in the study based on their relatively high or low scores on the Social Interaction Anxiety Scale (Mattick & Clarke, 1998), on which they had been previously screened. Upon entering the laboratory, participants were administered the Multiple Affect Adjective Check List-Revised (MAACL; Zuckerman & Lubin, 1965) to assess their baseline emotional states. Participants were then exposed to a situation involving either the presence or absence of a threat of peer evaluation. Finally, they were re-administered the MAACL a second time to assess their post-manipulation emotional states. Results indicated that shy participants experienced more anxiety than did non-shy participants, that participants who were anticipating peer evaluation experienced more depression than did those who were not, and that non-shy participants experienced more positive affect than did shy participants. However, there were no instances in which situational and dispositional determinants of evaluation apprehension interacted to significantly influence participants' emotional states.

27. The role of trauma characteristics in sexual and nonsexual traumas: Predicting post-traumatic stress disorder severity

Sara C. Haden, M.A.*, Angela Scarpa, Ph.D., and George Clum, Ph.D.
Department of Psychology

Being female is an inherent risk factor for the development of post-traumatic stress disorder (PTSD). The present study examined how characteristics of traumas (level of perceived injury severity, degree of life threat, and rating of traumatic experience) impact the relationship between the type of traumas and severity of PTSD symptoms. One-hundred and forty two female university students reported surviving various traumas including sexual (adult unwanted sexual experience, rape, N = 44), nonsexual-interpersonal (childhood abuse, abusive relationship, robbery, N = 32), and non-interpersonal types (accident, natural disaster, N = 66) and indicated characteristics of these traumas using self-report measures. The authors found that perceived injury ratings were more predictive of PTSD severity when experienced during specific traumatic events. In particular, survivors of sexual traumas who had reported high levels of perceived injury were most likely to develop severe PTSD. However, survivors of nonsexual traumas were likely to report more severe PTSD with lower levels of perceived injury. These findings highlight the importance of understanding how certain perceptions of traumatic experiences are conceptualized by female trauma survivors in relation to the specific trauma.

28. Predicting Proactive/Reactive Aggression in Children Due to Parental Anxiety and Depression

Akiho Tanaka*
Psychology

This study investigated the relationship between parental depression or anxiety and the display of proactive/reactive aggression in children. We further investigated a previous related study involving general parental psychopathology and the development of proactive or reactive aggression in children. We chose to look further into anxiety and depression, the two disorders we felt would more likely produce aggression in children. Parents and their children, ages 7-13, participated. Reactive and proactive aggression were assessed using the Child Behavior Rating Scale (parent form). Parental anxiety and depression were assessed from the Symptom Checklist-90 (SCL-90). We attempted to predict reactive aggression due to anxiety or depression in parents. In a one-tailed partial correlation test, the correlation between parental depression and reactive aggression in children showed no significance, whereas parental anxiety and child reactive aggression displayed a significance level of 0.04.

29. The Relationship between Perceived Loss and Guilt Feelings in Children Following a Residential Fire

James Hadder*
Psychology

During a NIMH-funded study of the psychological effects of residential fires on children, approximately 150 interviews were conducted. Among the various assessment instruments used in these interviews were the Resource Loss Scale (Jones, 1994) and the Fire Questionnaire (Child Version; Jones & Ribbe, 1991). Perceived guilt is among the many measures assessed by the Fire Questionnaire (FQ). Five of the FQ's items assess whether or not the children experienced fire-related guilt. Four of these items expand into a 4-point Likert-type scale that assesses the level of guilt. The Resource Loss Scale (RLS) measures object loss and personal resource loss. This analysis will first identify the children who answered positively on the FQ's guilt items. Once those children are identified, we will examine their RLS data concerning their level of loss. We will then compare loss levels with levels of guilt (as measured by the FQ). We hypothesize that, among the children endorsing guilt feelings, level of resource loss will be positively correlated with level of guilt. Possible treatment implications will be discussed.

30. Mathematics Doctoral Students: The Pursuit of a Ph.D.

J. L. Sayers*, G. M. Lloyd, and P. Burge

Department of Mathematics and Department of Educational Research and Evaluation

Since 1998, the number of mathematics doctorates awarded by colleges and universities in the United States has been declining. In 2001, United States citizens or permanent residents earned approximately half of these degrees, and women and minorities were underrepresented. The purpose of this study is to investigate the reasons that men and women choose mathematics as a major field of study and the factors that influence their success in earning doctoral degrees in mathematics. Another goal of this study is to offer an informative profile of mathematics doctoral students. Participants consist of three mathematics doctoral students purposely chosen from the current mathematics department at a large public university, and these participants represent a diverse population with respect to gender and race. The procedures of this research study included one interview and member check of that interview with each participant. Possible insights for mathematics department faculty regarding how to increase the number successful doctoral students and elevate the representation of women and minorities receiving mathematics degrees are given.

31. Conceptions of Caring in Physical Education as Reported by Preservice Teachers

D.M. Ravizza¹*, O. Lee², & P.L. Burge³

¹Department of Teaching & Learning, ²University of North Carolina-Greensboro, ³Department of Educational Research

Although a sense of caring is reported to be a common factor in successful school programs, the examination of physical education teachers' concept of caring has not been widely explored. The purpose of this study is to examine physical education preservice teachers' perceptions of caring during their student teaching experience. Four student teachers (1 male and 3 females) from physical education teacher education programs at two universities in southeastern United States participated in this qualitative investigation. The participants commonly reported that showing pedagogical concerns was an important concept of caring. They perceived that teaching and being accountable for the learning outcomes of their students were major caring roles. Establishing interpersonal relationships with students was another concept identified. The subjects also reported barriers to caring that included a lack of time and a difficulty of keeping a balance between care and discipline. Since student teachers focus greatly on teaching subject matter and effective classroom management, teacher education programs can serve as a period to enhance their caring capacity and utilize the student teaching experience as a practice of caring for student teachers.

32. Opportunity and Framing Structures in Living Wage Campaigns

Anastasia Cortes*
Management

This is a project for a case study comparison of successful and unsuccessful Living Wage campaigns, with specific concentration on the effects of opportunity and framing structures on the success of the chosen campaigns. The objective of the research is to identify common elements that are present in successful living wage campaigns and absent in failed campaigns. At this stage, identification and development of key opportunity and framing structures is underway, and case selection criteria are being established. The purpose of the project is to further the development and success of the Living Wage movement and better inform the strategy of individual campaigns.

33. Emotional Intelligence & Performance: The Role of Workplace Emotions

S. Krishnakumar* & T. Cobb
Department of Management

Emotional Intelligence (EI) has traditionally been defined in different ways. Recently, consensus is emerging in the research arena, in which EI is considered an ability, and is measured by performance on emotional problem solving tasks just like IQ. We describe the importance of that ability-model and its dimensions. Research on emotional intelligence has revealed that it is linked to performance in certain occasions. Emotions have been shown to arise from events occurring at the workplace, and also been shown to influence workplace behavior significantly. Research has also shown that even in high affect occupations, negative or positive emotions do not necessarily exert negative or positive influences on performance respectively. Integrating these three research findings, we propose a model which describes the effect of emotional intelligence (EI) on performance. We propose that the affect level varies among different occupations. We also propose that in occupations involving high affect, the influence of EI on performance will be stronger. Overall, we propose that the affect level in the workplace acts as a moderator on the relationship between EI and performance.

34. Virginia Tech Students' Satisfaction with On-Campus Housing

H. Lee* 1, J. Huh 2, and K. Park 2

1: Department of Apparel, Housing, and Resource Management

2: Department of Hospitality and Tourism Management

University on-campus housings have been a popular residential choice among students who want to have inexpensive housing on campus. The purpose of the study was to examine Virginia Tech students' satisfaction with their on-campus housing and to investigate attributes influencing the satisfaction. Both on-line and on-site questionnaire surveys were administered for two weeks and 191 students participated in the surveys. Data were analyzed using Factor Analysis, Multiple Regression Analysis, Independent t-test, and one-way Analysis of Variance. Findings were as follows: (1) on-campus housing attributes could be grouped into five factors: Social Space factor, General factor, Social factor, Room factor, and Location factor. (2) among the five factors verified, Social Space factor had the strongest influence on overall housing satisfaction; (3) respondents' satisfaction was lower than satisfied, and the five on-campus housing factors were shown to be less than respondents' expectation or about students' expectation; (4) respondents' academic level, length of residency, and the number of roommates had significant influence on satisfaction with on-campus housing attributes and overall housing satisfaction; (5) regardless of gender, respondents identified their 5 most important aspects of on-campus housing as bedroom, bathroom, roommates, meal plan, and comfort of temperature.

35. A Pilot Study of Exploring Reasons to Respond to An Online Survey

Kunsoon Park*

Department of Hospitality and Tourism Management

There are a variety of ways to conduct online surveys. Surveys can be conducted through email or they can be posted on the web and the URL provided to respondents who have already been approached. Online surveys are attracting considerable interest and will become more commonplace because of the methodological and economic advantages such as cost efficiency, speed of data collection, high response rate, short response time, and accuracy of data. The researchers who are planning to use online survey should know the reasons why respondents would respond to an online survey. The objective of this study is to explore the reasons why respondents would respond to an online survey. The results of this study will benefit the researcher in a way to increase the response rates. With the understanding the reasons of responding to online survey, the researcher will be able to develop the survey to meet the standard of the respondents.

36. Risk-Return Analysis of Fast-Food vs. Casual-Dining Restaurants: Who Moved my Cheeseburger?

Melih Madanoglu * and Kyuho Lee

Department of Hospitality and Tourism Management, Virginia Tech

Since 1950s, the restaurant industry surfaced as one of the fastest growing industries in the U.S. Fast food is the largest segment in the restaurant industry with projected sales of \$120.8 billion for 2003 (National Restaurant Association, 2003). Yet, the stumble of fast-food segment in recent years left the door wide open for the expansion of casual-dining restaurant segment. The purpose of this study is to investigate the risk-adjusted performance for fast-food and casual-dining restaurant segments for the five-year period between 1998 and 2002. The objective of this paper is to go beyond traditional risk-adjusted performance measures and utilize the one that takes into account the downside risk, and thus risk preferences of investors. The results of this study revealed that the fast-food segment was outperformed by casual-dining segment in all aspects: mean return, standard deviation, Sharpe Ratio and Upside Potential Ratio (UPR). The study concludes that the casual dining has a much brighter outlook than fast food segment. These findings are in congruence with the several restaurant industry analysts' view that cite numerous reasons for the downward trend of the fast-food segment.

Key words: Risk-adjusted performance, restaurant industry, fast food, casual dining, downside risk

37. Community Connections and Sense of Community among Older Adults

N. Brossoie*, J.A. Mancini, K.A. Roberto, and R. Blieszner

Dept. of Human Development

Connecting the fields of gerontology and community research is an emergent area of study. A probability sample of 1,499 adults 65 years and older who resided in rural areas responded to questions concerning their sense of community and community connections (community capacity, ease of making connections, active participation in the community, and informal supports). The hypothesized model in this study was developed to explore the effects of demographic variables and community connections on sense of community. Using multiple regression analysis, results indicate that community capacity, ease of connecting with others in the community, and having an informal support network are significant in predicting sense of community. Non-significant associations were found with regard to participation in community activities, age, sex, health status, and length of time living in the county. These findings suggest that key dimensions of aging (age, sex, health status) are less relevant when addressing sense of community when compared to associations and connections. Factors that predict sense of community may be amenable to community-level interventions, thus allowing for the development of sense of community among community members, which could ultimately lead to their participation as community resources.

Lecture Presentations

38. The Effects of Parenting Styles on the Development of Children's Emotional Intelligence

Alberto Alegre*
Human Development

This study investigated the relationship between parental depression or anxiety and the display of proactive/reactive aggression in children. We further investigated a previous related study involving general parental psychopathology and the development of proactive or reactive aggression in children. We chose to look further into anxiety and depression, the two disorders we felt would more likely produce aggression in children. Parents and their children, ages 7-13, participated. Reactive and proactive aggression were assessed using the Child Behavior Rating Scale (parent form). Parental anxiety and depression were assessed from the Symptom Checklist-90 (SCL-90). We attempted to predict reactive aggression due to anxiety or depression in parents. In a one-tailed partial correlation test, the correlation between parental depression and reactive aggression in children showed no significance, whereas parental anxiety and child reactive aggression displayed a significance level of 0.04.

39. Appreciative Inquiry: Answering the Call of the New Public Service

Shawn Erik Schooley*
Center for Public Administration and Policy

This paper argues that the organizational development (OD) approach of Appreciative Inquiry (Ai), originally developed by David Cooperrider (1987), can be utilized in the context of Janet and Robert Denhardt's (2003) New Public Service (NPS) movement. The New Public Service calls for a public administration that is centered on democratic ideals, actively engages citizens in collaborative dialogue, and a co-creation of shared meaning and understanding between civil servants and the citizenry they serve. Appreciative Inquiry is a positive organizational development approach that is based on social construction of reality and positive self-fulfilling prophecy. It involves sharing positive stories within a collective and building shared meaning and vision for the future. After demonstrating the nexus between the underlying principles and tenets of Appreciative Inquiry and the New Public Service, this paper presents a new role for civil servants entitled Appreciative Administrators (Aa), proffers a new practical public administration model predicated on Appreciative Inquiry called Appreciative Democracy (Ad), and discusses some potential implications of employing this new model.

Visual Research

40. Elnora's Peacock Persuasion

Sarah E. Taylor*

Apparel, Housing, and Resource Management

"Elnora's Peacock Persuasion" represents the grace, beauty, and mystical energy of the peacock. The purpose of this piece was to create a fabric that reinvented the natural iridescent beauty displayed by the bird. Inspiration for this piece evolved from the admiration of peacocks by my late grandmother, Elnora Liesfeld. This gown is made from lime green satin and has a full skirt of hand sewn peacock feathers. Hundreds of peacock feathers are encased in a tulle skirt to give this gown an exquisite look.

The bodice is strapless, and piping accents the neckline, lowered waist, and hem.

Design techniques include flat pattern, draping, and feather manipulation. This garment was designed and constructed in January 2003.

Undergraduate Research

41. Attentional and Conduct Problems in Childhood Proactive and Reactive Aggression

Shelby E. McDonald*, Zsafia Varga*, Angela Scarpa, Elizabeth E. Van Voorhees
Psychology Department

This study was designed to investigate the relationship between proactive and reactive aggression as they relate to attentional and conduct problems in 42 7-13 year-old children. It was hypothesized that a significant positive correlation would exist between reactive aggression (controlling for proactive) and diagnostic criteria for Attention Deficit Hyperactivity Disorder (ADHD) and with increased problems with vigilance. As predicted, results indicated a significant positive correlation between raw omission scores (higher scores reflect decreased vigilance) and parent-report measures of reactive aggression $r(39) = .353$, $p = .023$. Unexpectedly, a significant positive correlation was also found between parent-report measures of proactive aggression with ADHD symptoms measured from questionnaires, $r(41) = .326$, $p = .033$, and with ADHD diagnosis obtained by a diagnostic interview, $r(40) = .312$, $p = .044$.

We further examined the association between proactive aggression and ADHD by investigating the relationship of Oppositional Defiant Disorder (ODD) with proactive and reactive aggression. A significant positive correlation was found between ODD diagnosis and both proactive, $r(40) = .313$, $p = .044$, and reactive, $r(40) = .368$, $p = .044$, aggression. Step-wise regression analyses indicated that, when both ADHD and ODD were entered, ODD emerged as a better predictor of both forms of aggression.

Physical Sciences

42. A Short, Damp Weathering History of Jarosite Formation on Mars.

M. E. Elwood Madden*, R. J. Bodnar, and J.D. Rimstidt
Department of Geosciences

The recent discovery of a ferric iron-sulfate phase, possibly jarosite, within outcrops exposed at the Opportunity landing site ? a small crater within Meridiani Planum? indicates that liquid water was present and geochemically active in the region. Preliminary interpretations of the geochemical history of the site suggested that the area was soaked in water producing a persistently wet environment. However, geochemical modeling of basalt weathering at Mars-relevant conditions predicts that the observed ferric iron sulfate phase (as well as possible gypsum relicts observed on the face of the outcrop) formed as a result of water-limited, acidic chemical weathering of basalts. Aqueous alteration of a small percentage of the rock led to the absorption of these fluids into hydrous alteration phases, leaving the dry, salty, partially weathered regolith observed today. This suggests that small amounts of water may have precipitated the observed ferric iron sulfates over a geologically short timescale.

43. Cosmic-Ray Muon Flux Measurements in the Kimballton Mine

J. Billings*, H. B. Green, and B. Skinner*
Department of Physics

Modern ultra low-level particle detectors require such a low cosmic-ray background that it has become extremely important to understand and minimize the flux of such high-energy particles as muons. The Kimballton Mine in Southwest Virginia has been identified as a possible location for such experiments involving the detection of neutrinos, dark matter, etc. It is currently the favored site for the Low Energy Neutrino Spectrometer (LENS) detector, as well as a potential site for the NSF-sponsored Deep Underground Science and Engineering Laboratory (DUSEL). The purpose of this study is to produce an accurate description of the muon background in the Kimballton Mine through the creation of a theoretical model and a corresponding experimental measurement. We will present the results produced by the model for the current underground depth in Kimballton, as well as the predicted muon flux for the intended final DUSEL depth of 7000? (approximately 5,600 meters of water equivalent). We will also describe the setup and operation of the scintillation detectors used for measuring the muon flux rate, which will be used at the current depth of 2300?.

44. Phase I Analysis of Nonlinear Product and Process Quality Profiles

James Williams*
Statistics

In many quality control applications, use of a single (or several distinct) quality characteristic(s) is insufficient to characterize the quality of a produced item. In an increasing number of cases, a response curve (profile), is required. Such profiles can frequently be modeled using linear or nonlinear regression models. In recent research others have developed multivariate T^2 control charts and other methods for monitoring the coefficients in a simple linear regression model of a profile.

However, little work has been done to address the monitoring of profiles that can be represented by a parametric nonlinear regression model. Here we extend the use of the T^2 control chart to monitor the coefficients resulting from a nonlinear regression model fit to profile data. We give four general approaches to the formulation of the T^2 statistics and determination of the associated upper control limits for Phase I applications. We also consider the use of nonparametric regression methods and the use of metrics to measure deviations from a baseline profile. These approaches are illustrated using the vertical board density profile data presented in Walker and Wright (2002).

45. Defensive hostility and cardiovascular reactivity to active and passive stressors in male subjects.

E.J. Vella* & B.H. Friedman.
Department of Psychology

The autonomic characteristics of hostility and defensiveness were assessed in a sample of 55 male undergraduates selected on the basis of median splits from the composite Cook Medley Hostility Scale (Chost) and Marlowe Crowne Social Desirability Scale (MC) to create 4 groups: 15 Defensive Hostile (DH; high MC, high Chost), 16 High Hostile (HH; low MC, high Chost), 16 Defensive (Def; high MC, low Chost) and 8 Low Hostile (LH; low MC, low Chost). All subjects engaged in the following 3 minute tasks, during electrocardiogram recording: baseline, video game (VG), recovery, baseline 2, hand cold pressor (CP) and recovery 2. Cardiovascular (CV) response patterns in DH subjects were predicted to show enhanced CV reactivity in comparison to other groups. ANOVAS were conducted on change scores, task minus baseline, for the following CV variables: Heart rate (HR) and spectral derived high and low frequency power (HFP, LFP). Group effects were observed for HR reactivity and HFP reactivity. DH showed enhanced HR reactivity to CP in comparison to HH. HH displayed more HFP in response to both tasks than LH.

Engineering

46. Thermal Characterization of Integrated Power Electronics Modules (IPEMs)

Ying-Feng Pang*

Department of Mechanical Engineering

With the growing demands on the performance, cost, and the advance in packaging and interconnection technology, three-dimensional (3D) packaging provides higher density packaging. However, thermal management of the 3D package becomes an important issue. Therefore, it is critical to understand the thermal behavior of the high-density integrated modules. The chosen case study is an integrated power electronics module (IPEM). Numerical analyses and experiments were conducted to characterize the IPEM. The methodology for validating numerical model with experiment data was also discussed. We were able to predict the temperatures of the numerical models within 5% difference of the experimental data. The thermal characterization study showed that the position of the chips within the module resulted in different junction-to-ambient thermal resistance, R_{ja} . We also found that the chip temperature rise maintained a linear relationship with the power loss although the chips were packaged using embedded power technology

47. Understanding Subcritical Delamination Mechanism in Epoxy Bonds to Silicon Adherends

Hitendra K. Singh*, Kai-Tak Wan, Zuo Sun, and D. A. Dillard

Engineering Science and Mechanics Department, Virginia Tech

This study investigates the effects of temperature, preconditioning and liquid chemistry on the interfaces in silicon/epoxy systems. A series of experiments were conducted using wedge test to investigate the adhesion performance of the system subjected to a range of environmental conditions. The system was found to be relatively insensitive to the temperatures over a range of 22-60 °C but strongly influenced by the temperatures above 60 °C, depending on the environmental chemistry and nature of the adhesive used. Wedge specimens were also subjected to preconditioning in deionized (DI) water and other aggressive mixtures prior to the wedge insertion to study the effect of environmental exposure on the system. The wedge test data from preconditioned specimens was compared with standard wedge test and the system was found to be insensitive to preconditioning in DI water but shown to have been affected significantly by preconditioning in aggressive environments. Plots describing $da/dt - G$ (crack velocity versus strain energy release rate) characteristics are thereby presented and a comparison is made for different environmental conditions to quantify the system's behavior. A kinetic model to characterize subcritical debonding of adhesives for microelectronic applications was proposed based on molecular interactions between epoxy and coupling agent at the interface and linear elastic fracture mechanics, which could help us predict long-term deterioration of interfacial adhesion.

48. Progressive Failure Analysis of a Bonded Tongue and Groove Joint

Chris Cassino*, Eric Johnson, Robert West
Mechanical Engineering

Adhesive tongue and groove joints (TNG) have increased load capacity relative to comparable butt or step joint configurations. TNG also have a benefit in that they are capable of acting as a sealing gasket as well. However, the geometry of the bond line in the tongue and groove joint makes the response and failure analysis of it more difficult compared to simpler configurations. A finite element analysis is presented using cohesive zone modeling (CZM) of the adhesive for a TNG subjected to quasi-static tension loads. The adherends are made of nylon. The CZM constitutive law accounts for failure initiation using the peel and shear strength of the adhesive and for subsequent mixed mode crack growth using mode I and mode II strain energy release rates. The finite element model using the CZM for the adhesive is compared to a simple mechanical analysis of the joint and a butt joint model.

49. A Geometric Modeler for the Conceptual Design of Ducted Fan Unmanned Air Vehicles

Xinyu Zhang*, Arvid Myklebust
Department of Mechanical Engineering, AVID LLC
Paul Gelhausen, AVID LLC

Conceptual design of ducted fan vertical takeoff and landing, unmanned air vehicles (VTOL UAVs) demands a convenient and rapid tool for the geometric definition of UAV airframes. Software is available for modeling fixed wing aircraft. However, no tools exist for rapid conceptual-level modeling of ducted fan vehicles. The purpose of this research is to create a parametric, geometric modeler for rapid modeling of ducted fan UAVs. Based on bicubic B-Spline surface modeling, this modeler creates curvature continuous surfaces. This modeler is built on lessons from the fixed-wing tools in that it has increased flexibility required for the development of VTOL UAV concepts incorporating ducted fans. However, a number of challenges are faced in the development such as defining meaningful parameters and the connection of the modeler with design analysis codes in a user-friendly interface. Designed by using object-oriented methods, it is efficient and easy to maintain and extend. The modeler is able to model components such as Duct, Nose, Midsection, Afterbody, Fuselage, Pod, Actuator Disk Propeller, Blade/Vortex Element Propeller, Stator, Vane, Wing and Engine. The modeler is supported on Windows, Linux and Mac OS X. It has been successfully used in conceptual design studies of Allied and Honeywell VTOL UAVs.

50. Design of an oscillatory compression device for investigating the effect of mechanical compression on eukaryotic cell constructs

Theresa R. Cassino^{1*}, Roger Anderson³, Robert H. Sturges³, Brian J. Love², Kimberly F. Williams¹

¹ Department of Chemical Engineering, ² Department of Materials Science and Engineering, ³ Department of Mechanical Engineering

It is well known that mechanical forces can modulate the metabolic activity of eukaryotic cells such as chondrocytes and is an important component of homeostasis. Much current research is focused on analyzing both the effect of non-typical mechanical forces as well as the pathways responsible for transducing the mechanical signal within the cell. To address the effect of mechanical compression on chondrocyte activity, we have designed a simply oscillatory device which can apply mechanical compression to three-dimensional cell constructs. The device is capable of uniaxial controlled strain from a removable rotating cam with a stroke range between 0.25 mm and 4 mm. The system is designed for multiple waveforms as well as static compression. The unit is controlled by a PC based interface system. Frequencies between 0.1 Hz and 3 Hz can be achieved. The device is designed for use with standard tissue culture plates and is small enough to fit in an incubator. The prototype device has the capability of being outfitted with force gauges and other feedback sensors to directly track performance. This presentation will focus on device design and optimization as well as our preliminary results from cell studies using equine chondrocytes cultured in polymer matrix.

51. Cylindrical Sampling of Fractures

Xiaohai Wang*

Civil and Environmental Engineering

Mechanical and hydraulic behaviors of rock masses are significantly influenced by fractures. Since fractures are imbedded inside rockmass and are difficult to measure directly, the parameters to characterize fractures, such as size, orientation, intensity, and so on, are obtained mainly through outcrops, boreholes, tunnels, and other exposures.

The project intends to expand on the limited previous work on sampling fractures by cylinders; and to develop and test new methods to characterize fracture density, intensity and size based on easily obtained data from cylindrical samples as rock core, boreholes and tunnels.

The latest study focuses on estimating fracture size and aspect ratio of subsurface fractures by observed borehole data in sedimentary rocks. Since fractures in sedimentary rock are typically elongated in one direction, rectangles are considered to be good assumptions for their shapes. The study shows how information about sizes and aspect ratios of rectangular fractures can be discerned from study of borehole-fracture (or core-fracture) intersections.

52. Tennessee Rockfall Management System

Rose Brett*
Civil and Environmental Engineering

The Rockfall Management System developed for TennDOT takes advantage of current technology with regard to the collection, visualization and distribution of data. Field data can be recorded using either electronic forms on Personal Digital Assistants (PDA's) or equivalent paper forms. The PDA forms allow automatic error checking and direct synchronization with the rockfall hazard database. Hazard ratings, digital photographs, GPS coordinates, and other data are uploaded to a centralized database server, and distributed throughout TDOT using a web-based GIS. Information collected at rock slopes includes both quantitative and qualitative data on road and slope geometry, traffic and geologic characteristics, following the NHI model. These data are then used to determine a numerical hazard rating. The rating system used by TDOT is a modification of the NHI system that provides a more detailed and repeatable geologic characterization. With full implementation, Tennessee's RMS should lead to more efficient and economical use of resources, as well as improved safety.

53. Microwave Processing of Materials at Virginia Tech: A Review

Carlos Folgar*
Department of Materials Science and Engineering

A review is presented of the work that has been performed by MSE researchers in the area of microwave processing of materials. The primary focus of work to date has been in fundamental studies of microwave-material interactions, processing applications and equipment development. Additionally, the key advantages associated with microwave processing, including uniform volumetric heating, short processing times and selective heating, have been studied. Comparison studies have been performed using conventional and microwave heating to evaluate the primary differences between these processing techniques. Analysis of the experiments has led to the conclusion that it is possible to use microwaves successfully for many research and industrial materials processes.

54. Microwave Processing of Glass Ceramics Materials

Morsi Mahmoud* and David Clark
Department of Materials Science and Engineering

Technological progress is not possible without the discovery of new materials and new processing techniques. Although microwave processing is well-established and used extensively in many areas of materials processing nowadays, the exact mechanisms and effect by which the microwave interact with materials are not well understood. The main goal for this study is not only to produce new material (glass ceramic) from a new processing technique (microwave processing) but also to understand the crystallization mechanisms and kinetics of the glass crystallization using microwave energy. That goal will provide a fundamental understanding of how microwave energy interacts with glass and materials (in general) so that microwave processing technology can be better understood. Glass samples of Lithium disilicate ($\text{Li}_2\text{O}-2\text{SiO}_2$) will be nucleated by conventional heating, and then subjected to a careful heat treatment schedule by both conventional and microwave heating in order to convert the glass into glass ceramics material. A comparison between crystallization kinetics of glass ceramics materials produced by conventional heating and microwave energy will be made to help us to understand the crystallization kinetics of Lithium disilicate glass using microwave energy.

55. NANOLAB: A Tool for Evaluating Reliability of Defect-Tolerant Nano Architectures

Debayan Bhaduri* and Sandeep K. Shukla
Bradley Department of Electrical and Computer Engineering

Defect tolerant architectures will gain importance for micro-architecture designs based on nano-scale substrates due to uncertainties inherent at such scales. These are germane in the miniscule dimension of the devices, quantum physical effects, reduced noise margins, system energy levels reaching computing thermal limits, manufacturing defects, aging and many other factors. Recently, Markov Random Field has been proposed as a model of computation where the conventional Boolean logic is replaced by a notion of an energy distribution function based on Gibbs Distribution. In this computational scheme, energy distributions at various gate inputs and interconnects are considered, and Belief Propagation is used to propagate these probability distributions from the primary inputs to the primary outputs of a circuit. In this work, we take this approach further by automating this computational scheme and Belief Propagation algorithm. We have developed MATLAB based libraries for fundamental logic gates that can compute energy distributions and entropies at the outputs for specified discrete input distributions, and in the presence of signal noise modeled as uniform and Gaussian distributions at the inputs and interconnects. The power of this automation is illustrated by automatically deriving various reliability results for defect-tolerant architectures, such as TMR, CTMR and multi-stage iterations of these.

56. Extreme Formal Modeling with Property Ordering Effects

S. Suhaib*, D. Abraham and S. Shukla

Department of Electrical and Computer Engineering

We present a methodology of an agile formal method (XFM) recently invented by us, based on Extreme Programming (XP) concepts to construct abstract models from a natural language specification of a complex system. Formal models are mostly built for verification purposes in the industry. One of the usage modes for building formal models is Prescriptive Formal Models (PFM), which states the specification in a formal manner. We show how to incrementally build PFMs by adding user stories one by one into the model. "User Stories" are description of behaviors in a system and are captured as Linear Time Temporal Logic (LTL). We illustrate the methodology by regressively model checking each LTL property which we illustrate with various examples of traffic light controller, DLX pipeline and a Smart Building control system. We also analyze the effect of ordering LTL properties while using XFM when building PFMs with three different model building methodologies: arbitrary ordering, property based ordering and predicate based ordering of properties. We experimentally as well as mathematically prove that predicate based ordering is the optimal method of approach to build formal models with examples of the monitor of ISA bus and the arbitration scheme of Pentium Pro bus.

57. Towards A Heterogeneous Simulation Kernel for System Level Models: A SystemC Kernel for Synchronous Data Flow Models

H. D. Patel* and S. K. Shukla

Department of Electrical and Computer Engineering

As SystemC gains popularity as a modeling language of choice for system-on-chip (SOC) designs, heterogeneous modeling in SystemC and efficient simulation become increasingly important. However, in the current reference implementation, all SystemC models are simulated through a non-deterministic Discrete-Event simulation kernel, which schedules events at run-time. This sometimes results in too many delta cycles hindering the simulation performance of the model. The SystemC language also seems to target this simulation kernel as the target simulation engine. This makes it difficult to express different Models Of Computation naturally in SystemC. In an SOC model, different components may need to be naturally expressible in different Models Of Computations. Some of these components may be amenable to static scheduling based simulation or other pre-simulation optimization techniques. Our goal is to create a simulation framework for heterogeneous SystemC models, to gain efficiency and ease of use within the framework of SystemC reference implementation. We focus on Synchronous Data Flow models, where the rates of data produced and consumed by a data flow block are known a priori. Compile time knowledge of these rates allow the use of static scheduling resulting in significant improvement in simulation efficiency.

58. Ranking Function Discovery by Genetic Programming

Ming Luo*
Computer Science

Ranking function is instrumental for the success of an information retrieval (search engine) system. However nearly all existing ranking functions are manually designed based on experience, observations and probabilistic theories. This paper tested a novel ranking function discovery technique proposed in [Fan 2003a, Fan2003b] ? ARRANGER (Automatic Rendering of RANking functions by GEnetic pROgramming), which uses Genetic Programming (GP) to automatically learn the ?best? ranking function, for the robust retrieval task. Ranking function discovery is essentially an optimization problem. As the search space here is not a coordinate system, most of the traditional optimization algorithms could not work. However, this ranking discovery problem could be easily tackled by ARRANGER. In our evaluations on 150 queries of ad-hoc track from TREC 6, 7 and 8, the performance of our system (in average precision) got improved by nearly 16%, after replacing Okapi BM25 function with an automatically discovered function by ARRANGER. By applying pseudo-relevant feedback and ranking fusion on newly discovered functions, we improved the retrieval performance by up to 30%. The results of our experiments showed that our ranking function discovery technique ? ARRANGER ? is very effective in discovering high-performing ranking functions.

Lecture Presentations

59. Nonlinear Control of a Shape Memory Alloy Actuated Manipulator

Mohammad H. Elahinia*
Mechanical Engineering

SMA's consist of a group of metallic materials that demonstrate the ability to return to some previously defined shape or size when subjected to the appropriate thermal procedure. The shape memory effect is hysteretic and occurs due to a temperature and stress dependent shift in the materials crystalline structure between two different phases called Martensite and Austenite which are the low and high temperature phases, respectively. SMA actuators have several advantages for miniaturization such as excellent power to mass ratio, maintainability, reliability, and clean and silent actuation. The disadvantages are low energy efficiency due to conversion of heat to mechanical energy and inaccurate motion control due to hysteresis, nonlinearities, parameter uncertainties, and difficulty in measuring variables such as temperature. The objective of this research is to develop a nonlinear control algorithm for accurate positioning of a single degree of freedom (1-dof) robotic arm actuated by a Shape Memory Alloy (SMA) wire. A model for SMA actuated manipulator is presented. The system is modeled for simulating different control algorithms. The model includes nonlinear dynamics of the manipulator, a constitutive model of the Shape Memory Alloy, and the electrical and heat transfer behavior of SMA wire. The model is verified against experimental results.

Despite the special feature of SMA's, they have not been fully exploited by developers, particularly in devices employing feedback control systems. Several reasons account for this. The devices are inherently nonlinear, characterized by a hysteresis loop and saturation. Material scientists have provided numerous mathematical models that describe the response of SMA's, but it is not easy to choose which SMA model is most appropriate for each application. Furthermore, a given model may contain many unknown parameters, further discouraging from attempting to design a model-based control system.

In particular, SMA's exhibit hysteresis, time-varying parameters, saturation, and a nonlinear mapping between material temperature and material properties. The primary technique that mainly is used in this work is based on Variable Structure Control (VSC). Due to model uncertainty and nonlinear behavior of SMA actuator this method is a natural choice for these kind of systems. Simulations and experiments with VSC shows that the SMA-actuated robot has a fast, robust and accurate performance.

60. Thrust Augmentation Through Active Flow Control: Lessons From a Bluegill Sunfish

Imran Akhtar*
Engineering and Science Mechanics (ESM)

Numerical simulations have been used to analyze the effect, that vortices shed from one flapping foil, have on the thrust of another flapping foil placed directly downstream. The simulations attempt to model the dorsal-tail(caudal) fin interaction observed in a live bluegill sunfish by Drucker & Lauder (2001) for a live bluegill sunfish using Particle Image Velocimetry (PIV). The simulations have been carried out using a Cartesian grid method that allows us to simulate flows with complex moving boundaries on stationary Cartesian grids. The simulations indicate that vortex shedding from the upstream dorsal fin is indeed capable of increasing the thrust of the tail (caudal) fin significantly. However, this thrust augmentation is found to be quite sensitive to the phase relationship between the two flapping fins.

The numerical simulations allows to examine the underlying physical mechanism for this thrust augmentation.

61. A Suite of solutions and a Systems Architecture for optimization studies in aerospace and defense

Sai Sundarakrishna*

Department of Industrial and Systems Engineering

In an effort to foster novel optimization/analysis studies, 3 new methods of technology integration were used to develop 3 products, which blend seamlessly with robust tools of analysis. They tap the Open Sources (Open I-DEAS) and Interoperable Standards (CORBA), and use trusted architectures (COM, J2EE). 1) A full-fledged integration of I-DEAS CAE system with ModelCenter (a design environment to perform sensitivity analysis and trade studies) was developed. This helps the analysts to target design optimization of aerospace components in a distributed model environment. 2) The realization and implementation of this framework was made use of in performing the nonlinear systems convergence studies by leading defense contractors. To accomplish this, a component tool in a distributed parallel environment was developed. 3) The research also proposes a scalable systems-architecture for multiple autonomously cooperating agents that communicate with each other to form a widely distributed system for solving complex, multi-objective problems. The system will be based on ModelCenter, and on JADE, a Java-based FIPA-compliant agent framework. The research outlines the new architecture and the products along with an integral framework that solves adaptive optimization problems in Network centric warfare to optimize the battlefield decision-making scenario

62. Understanding System Dynamics via Transfer Function in Modeling Production Control Systems

N.H Fong*, Robert H. Sturges and John Shewchuk

Grado Department of Industrial and Systems Engineering

The term System Dynamics (SD) refers to a business system modeling technique that employs causal loop diagrams (CLD) and stock-and-flow diagrams (SFD) to describe information and materials flow. However, for most control engineers, a mathematical model of a dynamic system is usually described in terms of differential equations based upon physical laws. Although a SD model is built upon the feedback concepts of control theory, it does not specify such parameters as the variable loop gain or the location of the closed-loop poles for the given system model. There is no one-to-one correspondence to model dynamic production systems between the differential equation formulation and the CLD and SFD applied in the SD approach. In this paper, an alternative method to model and analyze two production control systems is investigated using the Transfer Function (TF) and the Block Diagram (BD) representation of control engineering. The task of translating CLD and SFD terminologies into TF and BD descriptions will be discussed in detail. Transient-response system parameters such as undamped natural frequency and damping ratio are introduced to determine other key dynamic system performance characteristics. The effects of significant system variables on particular measured responses are addressed.

63. Contracts Verses Covenants in Integrated Project Delivery Systems

David W. Martin* and Dr. Anthony D. Songer
Construction Engineering & Management

Historically, construction project delivery systems segregate the owner, designer, and contractor into contractually adversarial relationships. Emerging project delivery systems such as construction management, design-build and supply-chain management unite the project participants into collaborative working environments. Improved project performance demonstrated by such methods is attributed largely to the collaborative environment they create. While these project delivery systems are making great strides in improving collaboration between project participants, a fundamental shift from traditional adversarial contractual relationships is yet to be realized. The inherent spirit of contracts currently employed by construction projects act in opposition to true collaboration. Applying prisoner's dilemma theory to the concept of collaborative contracts suggests limits to emerging delivery methods. This paper introduces the concept of covenant-based collaboration as the next generation of integrated project delivery systems. Covenants encourage mutual orientation, focus on goal commitment, and unite project participants into a trust-based relationship causing altruistic behaviors toward each other. The limitations of prisoner's dilemma are overcome through covenant allowing project performance improvement beyond current delivery approaches. A covenant-based integrated project delivery case study illustrates the covenant concept.

Paul Torgersen Awards

64. Quantifying long-term hydrologic and NPS pollutant flux response in an urbanizing watershed.

Mark Dougherty*

PhD candidate, Civil & Environmental Engineering

This research quantifies hydrologic and nonpoint source (NPS) pollutant response from four headwater basins in the Occoquan River in northern Virginia using 24 years of stream data. Results document that hydrologic and NPS pollutant response in the urbanizing Cub Run basin is different from non-urban basins. Higher annual NPS sediment and nutrient fluxes from Cub Run are linked with increased urban soil disturbance and storm volumes resulting from higher mean impervious surface (IS). Storm fluxes of NPS particulate phosphorus and nitrogen make up the majority of nutrient fluxes from all basins. Higher total suspended solids and nutrient fluxes in Cub Run basin during the growing season demonstrate the impact of replacing vegetated cover with urban IS. Regression models confirm that IS and precipitation are significant predictors of basin discharge and NPS pollutant flux. Hydrologic models explain 65 percent of the variability in annual discharge data. At least 50 percent of the variability in soluble phosphorus flux and 58 percent of soluble nitrogen flux is explained by regression with precipitation, change in IS, and agricultural land use. Results link both urban soil disturbance and conventional agriculture with NPS sediment and nutrient loads in the Occoquan basin.

65. Central Eastern United States: 2000/2003 Seismic Implications

Morgan Asbury Eddy*, MS, EIT

Department of Civil and Environmental Engineering

Numerous states have adopted the International Building Code (IBC2000, 2003). In the Central and Eastern US (CEUS), this new code has introduced stringent seismic considerations of constructed facilities. The code is a combination of recent regional codes and relies mainly on standards that were developed in the western US. As a result, it appears that the code may not be directly applicable to some CEUS regions due to differing geologic conditions. Accordingly, the main objectives of this research are to address the CEUS unaccounted geologic conditions and perform site response analyses of CEUS sites to assess implications of the IBC 2003. Three CEUS sites were selected to provide a range of results: Aiken, Charleston, and Columbia, South Carolina. These sites are of increased importance from a seismic standpoint because of the historical 1886 Charleston, SC earthquake which caused 100 deaths. It is important that structures in the CEUS are built to withstand a devastating earthquake and that the current structures are classified and modified to prevent loss of life. Therefore, the results of the research are vital to the livelihood of civilization throughout the CEUS.

66. Using Magneto-Rheological Dampers in Semi-active Tuned Vibration Absorbers to Control Structural Vibrations

Jeong-Hoi Koo*

Department of Mechanical Engineering

This research studied a novel semi-active Tuned Vibration Absorber (TVA) that strives to combine the best features of passive and active TVA systems. The semi-active TVA proposed in this study employed a versatile Magneto-Rheological (MR) damper as a real-time, controllable damping element in the TVA to enhance its performance. To investigate the effectiveness of the novel TVA system in reducing structural vibrations, a numerical study was first conducted, which identified the 'best' control law for the semi-active MR TVA. A test apparatus, a structure mass coupled with an MR TVA, was then used to experimentally evaluate the dynamic performance of the MR TVA. To further validate the effectiveness of the TVA, a prototype MR TVA was built and applied to a full-scale structure system (laboratory floor). According to the results, the semi-active TVA outperformed the equivalent passive TVA in reducing the maximum vibrations of the primary structure. Moreover, the semi-active TVA was more robust to off-tuning when compared with the passive system. The findings of this research will be the foundation of further research into the use of semi-active MR TVAs for structural vibration control in enhancing safety and serviceability of mechanical and structural systems (such as buildings, bridges).

67. Vacuum Assisted Resin Transfer Molding (VARTM): Model Development and Verification

X. Song*

Department of Engineering Science and Mechanics

Vacuum Assisted Resin Transfer Molding (VARTM) process is a promising method to manufacture large and complex composite structures for aerospace applications. However, this is a relatively complex process to perform well. The fundamental mechanisms involved in the process were investigated, and a comprehensive process simulation model was developed as an efficient design tool to help select and optimize the processing parameters. The model includes three submodels: resin flow through the preform, compaction and relaxation of the preform, and viscosity and cure kinetics of the resin. The simulation model was verified by the experiment of fabricating flat composite panels with VARTM process. The simulation model accurately predicted the resin flow phenomenon during the infusion process, and qualitatively simulated the complex compaction and relaxation behavior of the preform. The simulation code was also used to investigate the VARTM of a new type of sandwich structure with through-the-thickness reinforcements. The sandwich structure consists of two carbon face sheets and a foam core. The face sheets and foam core are stitched together in the transverse direction. The model accurately predicted the resin flow patterns and the effect of the stitch density on the infiltration process.

68. The Development of a Computational Model of a Proton Exchange Membrane Fuel Cell

Nathan P. Siegel*
Mechanical Engineering

In recent years, there has been a great deal of activity directed at making a transition from the fossil fuel based energy infrastructure in place today to one based on hydrogen. This change will require the development of several key technologies that allow for the efficient production, storage, and usage of hydrogen. The proton exchange membrane fuel cell (PEMFC) is a critical element of the proposed hydrogen based energy infrastructure. PEMFC technology, which has been around for decades, has only recently become commercially competitive with traditional power systems due primarily to technological advancements over the last few years. These advancements have been made possible by experimental work and also by the development of computational models that offer fuel cell researchers a means of investigating fuel cell operation at a fundamental level while at the same time enabling them to evaluate and optimize fuel cell design concepts.

The primary goal of this research is to develop a PEMFC model that includes all of the major transport processes occurring within the fuel cell and can accurately simulate its performance over a range of operating conditions. The results generated with the model are used to investigate areas of particular importance to fuel cell operation, namely the transport of oxygen and liquid water within the fuel cell and the links between the physical structure of individual cell components and overall performance.

69. The Effects of Vegetation on Stream Bank Erosion. Tess Wynn. Biological Systems Engineering

Tess Wynn*
Biological Systems Engineering

A better understanding of the role of vegetation in stream bank erosion is necessary to improve stream restoration design and to model the effects of landuse change on channel stability. The goal of this research is to compare the effects of woody and herbaceous vegetation on stream bank erosion by quantifying root density in stream banks as a function of vegetation type and density, determining the effect of vegetation type on freeze/thaw and desiccation activity, and measuring the erodibility and critical shear stress of vegetated banks in situ.

Twenty-five field sites in southwest Virginia were sampled. Root length density (RLD) with depth, above ground vegetation density, stream bank soil erodibility and critical shear stress, and several vegetation and soil chemistry factors that could potentially impact the fluvial entrainment of soils were measured at each site. Additionally, soil temperature and soil water potential were continuously monitored at six paired field sites for one year.

Preliminary results of this study suggest that streamside forests provide the greatest resistance to bank erosion. Further analysis is being conducted to assess the role of vegetation in stream bank erosion and to develop predictive tools for the design and evaluation of stream restoration projects.

70. Sensitivity Analysis of the Reference Watershed Approach in Benthic TMDLs

Rachel Wagner* and Dr. Theo A. Dillaha
Biological Systems Engineering

The benthic macroinvertebrate community is often used as an indicator of the health of stream life. When this community is impaired, the Total Maximum Daily Load (TMDL) process, outlined in the Clean Water Act, is initiated. Many stressors that cause a "benthic impairment" have no water quality standards, requiring a method other than standard-based reductions to determine pollutant reductions. The Reference Watershed Approach finds a watershed that has similar characteristics to the impaired watershed but is itself unimpaired. The stressor loading in the reference watershed is established as the target level for the stressor in the impaired watershed. Restoration of the benthic community is expected if the stressor load in the impaired watershed is reduced to the level in the reference watershed. Stressor loads are calculated using computer models that employ equations predicting watershed processes. In this research, the Reference Watershed Approach and computer modeling of stressors are examined. Is there a difference in stressor loadings when different reference watersheds are used? Does the output from different computer models result in different stressor loadings? Stroubles Creek is a benthically-impaired waterbody in Montgomery County, Virginia; sediment is the primary stressor. This creek serves as the study site for this research.

71. Partitioning Between Sediment-Adsorbed and Free Escherichia Coli

Leigh-Anne Henry* and Theo A. Dillaha
Biological Systems Engineering

Despite the ubiquitous nature of bacterial water body impairments, a scarcity of comparable research on the fate and transport of bacteria has forced hydrologic simulation models to assume that bacteria travel as dissolved chemicals. In reality, extensive studies have shown bacteria preferentially attach to soil aggregates, and behave very differently from planktonic, or unattached, bacteria. The objective of this study was to identify a laboratory method to partition between soil-attached and planktonic *Escherichia coli*, a common pathogen indicator. Methods were evaluated using laboratory samples of pure culture *E. coli* and sterile topsoil in buffered dilution water. The most appropriate method identified measured attachment indirectly as the difference between total and planktonic *E. coli* concentration. Total concentrations were determined using the chemical surfactant Tween-85 to separate bacterial cells from soil aggregates. Planktonic bacteria were operationally defined as those cells able to pass through an 8 μ m screen. Evaluation of laboratory samples revealed that over 75% of bacteria were attached after one hour of mixing with topsoil. This method is currently being used to develop an equation describing this partitioning for use in hydrologic computer models.

72. Determining computer worm spread patterns in local area networks

Rishikesh Pande* and Randy Marchany
Department of Computer Science

Earlier research on network worms has concentrated on predicting the number of computers a worm will infect and how long it takes to do so. Our research determines if plant epidemiological techniques, used in investigating the spread of plant viruses in a field, can be adapted to investigate the spread of computer viruses in a Local Area Network (LAN). This approach is based on the application of mathematical models and variables inherent to plant epidemiology. In particular, a statistical variable, spatial auto-correlation, has been identified as a candidate variable that can help predict the spread of a worm over a LAN. We apply spatial- autocorrelation to the geography and the topology of the LAN, and describe the results of our approach. Knowing the network path pattern worms follow helps build an early warning system for the subnet. We outline the design of an application, the Middle-range Intrusion Detection System (MIDS) with such capabilities. Such an approximate route can help determine the levels of countermeasures to be taken, the order in which they should be taken and decide upon the individuals to be notified.

73. Reducing the Risk of Severe Eye Injuries: Rupture Stress for Synthetic and Finite Element Eye Models

E.A. Kennedy* and S.M. Duma
Department of Mechanical Engineering

More than 30,000 Americans lose sight in at least one eye each year as the result of ocular trauma. In automobile crashes where the occupants are exposed to a deploying airbag, approximately 3 percent sustain an eye injury. Until now, the material properties and rupture strength of the human eye were not known under dynamic loading conditions. The purpose of this research was to determine the rupture strength of the human eye and the material properties of the eye under quasi-static and dynamic loading conditions. This research will allow engineers to develop better tools to predict the likelihood of globe rupture due to blunt impact. Twenty postmortem human eyes were mounted in a test apparatus that allowed pressurization of the eye with a physiological fluid. The average rupture pressure under quasi-static loading was 0.36 ± 0.20 MPa with an average rupture stress of 5.34 ± 3.21 MPa. Under dynamic loading, the average rupture pressure was found to be 0.91 ± 0.29 MPa and the average rupture stress was found to be 12.81 ± 6.71 MPa. The difference between the quasi-static and dynamic tests is significant ($p=0.01$) and proves that synthetic and finite-element eye models using previously determined material properties of the eye from quasi-static tests will lead to inaccurate predictions of the risk of eye rupture in impact simulations.

74. PRIMA - Privilege Management and Authorization in Grid Computing Environments

Markus Lorch*

Department of Computer Science

Computational grids and other cyber-infrastructures require more powerful and more flexible authorization mechanisms to realize fine-grained access-control to resources. Computational grids are used for collaborative problem-solving and advanced science and engineering applications. Many grid usage scenarios depend on small, dynamic working groups. Existing solutions for the management and enforcement of access privileges fail to provide the necessary flexibility and granularity to support these scenarios. The reasons include imposed overhead due to required administrator intervention, coarse granularity that only allows for all-or-nothing access control decisions or the requirement for trusted application code to implement finer-grained access control.

The model and system developed in this research, PRIMA, focuses on the issues of management and enforcement of fine-grained privileges. The PRIMA model combines advantages of existing access control mechanisms with novel approaches and can be used in place of, or in combination with prevalent access control mechanisms. In summary PRIMA mechanisms enable the use of fine-grained access rights, reduce administrative costs to resource providers, enable ad-hoc and dynamic collaboration scenarios, and provide improved security service to long-lived grid communities while leveraging other work in the grid computing and security domains.