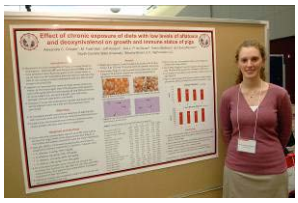
Fifth Annual Graduate Student Research Symposium

Congratulations to the winners of the Fifth Annual Graduate Student Research Symposium! The purpose of the Symposium is to showcase the outstanding quality and diversity of graduate-level research at NC State. Each Director of Graduate Programs was invited to nominate up to five graduate students from their respective programs. Winners were announced from eight categories. The Symposium was held March 10, 2010 at the McKimmon Center.

Agricultural Sciences



Alexandra Chaytor (Animal Science) won first place for her work, "Effect of chronic exposure of low levels of aflatoxin and deoxynivalenol on growth and immune status of pigs." Mycotoxins are toxic metabolites of fungi commonly found on cereal grains. Aflatoxin and deoxynivalenol are two toxins commonly found on cereal grains in the United States. The study investigated the impact on the growth and immune responses of pigs fed diets containing varying concentrations of these mycotoxins at amounts under FDA regulatory standards.

Stephen Meyers (Horticultural Science) received second place for "Palmer Amaranth Interference in Sweetpotato." North Carolina produces 40% of the sweetpotato crop in the United States, yet yield and quality are greatly threatened by Palmer amaranth (*Amaranthus palmeri* S. Wats.) – a weed that is very difficult to control, and consequently, the most troublesome to sweetpotato producers. Field studies were conducted in Clinton and Faison, North Carolina, during 2007 and 2008. The goal of the studies was to establish parameters for the interaction of Palmer amaranth and sweetpotato that can guide growers in implementing control strategies for this weed.

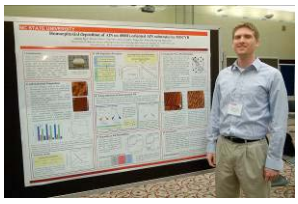
Education

Glenda Harrell (Curriculum and Instruction) received first place for her presentation on "Multiple Benefits of Two-Way Dual Language Immersion." Harrell explored the reasons and solutions for the poor academic performance and high drop-out rates for students who are learning English as a second language, despite federal and state mandates to provide effective schooling for these students. Most promising are the Dual Language (DL) two-way immersion programs. Results for the DL programs indicate that students score significantly higher on state reading tests. Additionally, native English speakers not only outperformed their peers in English, but they acquired bilingual proficiency.

Gemma Mojica (Mathematics Education) was awarded second place for "Preparing Pre-service Elementary Teachers to Teach Mathematics with Learning Trajectories." Research over the past two decades has focused on understanding how students think and how that thinking has become more sophisticated over time. Mojica's study explored to what extent and in what ways learning trajectories could be used by pre-service elementary teachers (PSTs) to build models of student thinking. Over an eight-week period, PSTs were able to deepening their understanding of mathematics and knowledge for teaching mathematics, as well as building more prices models for student thinking, with the goal to incorporate the models into instructional practices.

Engineering

Arjun Krishnan (Chemical and Biomolecular Engineering) was awarded first place for his research with "Selectively Solvated Block Copolymers upon (Electro)Mechanical Deformation." Existing high-performance electroactive polymers afford little versatility in terms of property development . Plus, these devices are energetically inefficient and expensive to fabricate. The objective of the study was to design lightweight, resilient, inexpensive, and recyclable electoactive polymers to replace the traditional metal/ceramic-based, mechanical actuators. The most promising solution is network-forming triblock copolymers, which possess excellent electro(mechanical) properties, including shape memory, that can easily extend to other technologies.

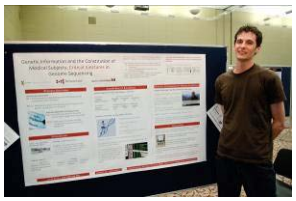


Anthony Rice (Materials Science and Engineering) received second place for "Homoepitaxial deposition of AlN on (0001)-oriented AlN substrates by MOCVD." Aluminum nitride (AlN) is a semiconductor material that has recently become of commercial and military interest. A principle commercial application for AlN is the fabrication of ultraviolet light emitting diodes to serve as water and air disinfection devices. Homoepitaxial deposition of AlN on single crystalline AlN substrates allows for reduced defect density and improved electronic device performance. Our work includes a study of AlN

substrate surface preparation and the subsequent chemical and microstructural characterization of deposited AlN thin films.

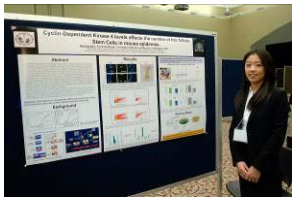
Humanities and Design

Meghnaa Tallapragada (Communication) was awarded first place for her research on "Public engagement in developing countries: A proposal for engagement for nanotechnology in water purification." The death toll in the world among humans and various aquatic animals due to water contamination is alarming. Nanotechnology offers effective and efficient methods of purifying water as an alternative to existing filtration systems, but comes with risks and uncertainties. In her study, Tallapragada has developed a public engagement model that customizes Western communication theories to meet the needs of rural regions non-Western developing nations.

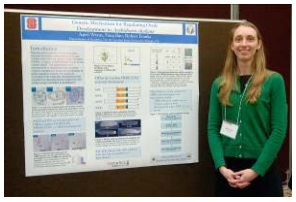


Jason Kalin (Communication, Rhetoric, and Digital Media) won second place for his poster presentation on "Genetic Information and the Constitution of Medical Subjects: Critical Junctures in Genome Sequencing." Genome sequencing is becoming more sophisticated and economically feasible, which is an advantage to personal genetic medicine. Two critical junctures surround the increased use of genetic medicine wherein medical subjects are neglected in favor of their genetic information and what can be done with it by genome-sequencing companies. By studying how genome sequencing is being communicated to the public in popular news sources, Kalin's research explores a third critical juncture wherein medical subjects are being reconstituted through genetic information as embodiments of their genes and, potentially, in control of their genes. This third critical juncture represents a shift in what it means to have a healthy body and to lead a healthy life.

Life Sciences

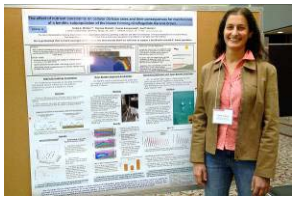


Sun Hye Kim (Comparative Biomedical Sciences) was awarded first place for her study, "Cyclin-Dependent Kinase 4 levels affects the number of hair follicle Stem Cells in mouse epidermis." In humans, Cyclin-dependent kinase 4 (CDK4) has been found mutated in familial melanoma, amplified or overexpressed in human gliomas, sporadic breast carcinomas and sarcomas. We have demonstrated that CDK4 ablation inhibits chemically-induced mouse skin papillomas, whereas forced expression of CDK4 in mouse epidermis (K5-CDK4) accelerates malignant progression of papillomas to Squamous Cell Carcinomas (SCC). However, the mechanisms by which changes in CDK4 protein levels control skin tumorigenesis have not been established. This study explores the hypothesis that CDK4 deletion or overexpression affects tumorigenesis by altering the characteristic and/or the number of keratinocyte stem cells.

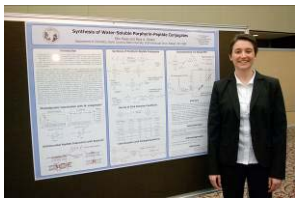


April Wynn (Genetics) received second place for her poster presentation on "*SEUSS*-Related Transcriptional Regulatory Complexes are Vital for Ovule Development in *Arabidopsis thaliana*." Reproductive success in flowering plants requires the proper development of ovules. Ovules arise from the carpel margin meristem, a region of meristematic tissue on the carpel margin. The specification and development of ovules from this structure require a spatial and temporal coordination of gene regulation events. The goal of this study is to understand the molecular mechanisms that regulate the development of ovules from the carpel margin meristem in *Arabidopsis*.

Mathematical and Physical Sciences



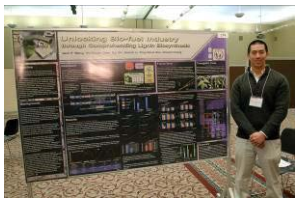
Linda Waters (Marine, Earth, and Atmospheric Sciences) won first place for her research "The effect of nutrient constraints on cellular division rates and their consequences for maintenance of a benthic subpopulation of the bloom forming dinoflagellate *Karenia brevis*." The source of toxic "red tide" blooms occurring along the coastline in the eastern Gulf of Mexico could potentially be a subpopulation of dinoflagellate cells remaining near the benthos in deep oligotrophic water on the west Florida shelf. Modeling, water sampling, and behaving drifters were combined to assess what nutrients would be necessary to support that population and whether nutrients were present at those levels in a region known to have regular bloom occurrences. Results of the study indicated that benthically oriented *K. brevis* cells will undergo cellular division and subsequent bloom formation if exposed to elevated concentrations of nutrients extending into a water column for two or more meters.



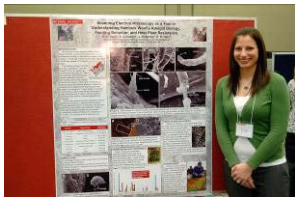
Elke Feese (Chemistry) was awarded second place for her poster presentation on "Synthesis of Water-Soluble Porphyrin-Peptide Conjugates." The synthesis of porphyrin-peptide conjugates (PPCs) is of broad interest given the range of potential applications of such molecules. PPCs could be exploited as selective targeting agents for anti-cancer or anti-viral therapeutics. Furthermore, PPCs could serve as novel water-

soluble biomimetic catalysts whose reactivity might shed insight into aspects of hemoprotein enzyme mechanisms. This study investigates two possible routes to the synthesis of water-soluble cationic PPCs.

Natural Resources

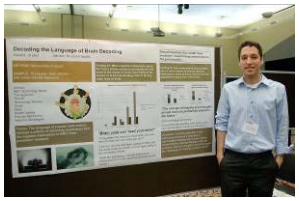


Jack Peng-Yu Wang (Forestry) was awarded first place for his poster presentation, "Unlocking Bio-fuel Industry through Comprehending Lignin Biosynthesis." Bio-fuel research is receiving more focus as oil prices rise and alternative sources of secure renewable energy becomes more desirable. Fundamental to the production of bio-fuels from plants, efficient extraction of biomass for energy is dependent on lignin reactively. Although much is known about lignin, the underlying mechanisms of it's reactivity remains largely unknown. The objective of Wang's study is to investigate regulators of lignin reactivity and generate bio-fuel specific plant with favorable lignin trait for high reactivity and efficient bio-fuel production.



Kelly Oten (Entomology) was awarded second place for her poster presentation on "Scanning Electron Microscopy as a Tool in Understanding Hemlock Woolly Adelgid Biology, Feeding Behavior, and Host Plant Resistance." The hemlock woolly adelgid (*Adelges tsugae* Annand) is an exotic insect which causes widespread mortality of hemlocks in eastern North America. Introduced to Richmond in 1951, their range has spread to 18 eastern states. Both chemical and biological control methods are expensive and impractical. However, only two species of hemlocks in eastern North America succumb to the infestation. This study examines hemlock woolly adelgid's feeding mechanisms in order to determine susceptibility of the nine species of hemlocks. The two species of hemlocks in eastern North America are the only species that succumb to the infestation. Hemlocks in the pest's native range (Asia, Pacific northwest) show levels of nonpreference or tolerance. This study examines hemlock woolly adelgids feeding mechanisms in order to determine susceptibility of the nine species of hemlocks.

Social Sciences and Management



David Gruber (Communication, Rhetoric, and Digital Media) was awarded first place for his poster presentation, "Decoding the Language of Brain Decoding." Functional magnetic resonance imaging (fMRI) has enabled neuroscience researchers to visualize patterns in the brain that can help them predict, with surprising accuracy, what a person is thinking. Gruber examines how brain-prediction, as a particularly controversial fMRI research agenda, has been presented to the general public. Using verbal data analysis in conjunction with a critical rhetorical analysis, the study locates recurring grammatical features from a collection of popular news articles and then explores the rhetorical implications of those features in this context. Ultimately, this project concludes that the articles under examination display a pattern of consistently distancing researchers from the negative implications of the research and, through an over-reliance on non-human actors, promote a narrative of technological determinism.

Matthew Kutch (Economics) was awarded second place for his poster presentation on "Are Complementary and Alternative Medicines Cost-Effective in Treating Common Mental Health Disorders? A Survey Approach." A recent, large-scale nationally representative survey estimated the 12-month prevalence for any mental health disorder at over 25% of the adult population. Anxiety disorders (18.1%) and mood disorders (9.5%) had particularly high rates of prevalence. In 1997, expenditure for complementary and alternative medicines, such as acupuncture, chiropractics, herbal remedies, massage therapy, homeopathy, energy healing, and biofeedback, was $21.2 billion. Complementary and alternative medicine was also used at a higher rate than traditional therapies, such as psychotherapy and pharmacotherapy.