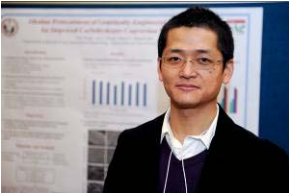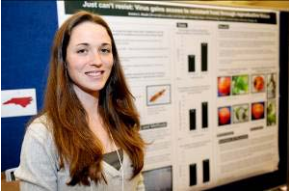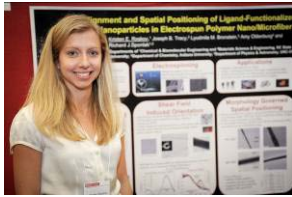# Sixth Annual Graduate Student Research Symposium

Congratulations to the winners of the Sixth Annual Graduate Student Research Symposium! Each year, the Symposium showcases the outstanding quality and diversity of graduate-level research at NC State. First-, second-, and third-place winners have been announced in eight categories. The Symposium was held on March 21, 2011 at the McKimmon Center.

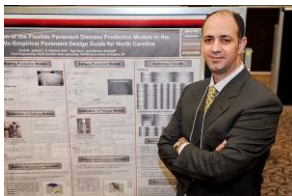| AGRICULTURAL SCIENCES	
	Nape Mothapo (Soil Science) won first place for her work, *Hairy Vetch Use History Affects Nodulation and Diversity of Rhizobium leguminosarum*. Contribution of biological nitrogen fixation to soil fertility can be improved through functional knowledge of nodulation and rhizobia diversity associated with popular legume cover crops, such as hairy vetch (HV). This study explores how a history of HV cultivation influences rhizobia diversity and nodulation and examines genetic differences in the rhizobia that nodulate distinct HV genotypes.
	Ziyu Wang (Biological and Agricultural Engineering) took the second-place award for *Alkaline Pretreatment of Genetically Engineered Switchgrass for Improved Carbohydrates Conversion Efficiency*. Increased demand for energy and a limited supply of fossil fuels has prompted exploration of alternative renewable energy sources. Wang's study explores switchgrass as a promising bioenergy crop for ethanol production, and particularly, the effects of sodium hydroxide and lime pretreatments on improved production of total reducing sugar as well as glucose and xylose from transgenic switchgrass. The research also examines the impact of lignin modification on facilitating biomass saccharification.
	Jessica Houle (Entomology) presented *Just Can't Resist: Virus Gains Access to Resistant Host through Reproductive Tissue* and won third place in the Agricultural Sciences category. Control of diseases in crops through host plant resistance can be compromised by differential expression of resistance across plant tissue types. This study explores whether reproductive tissue in mature tomato plants may not have the ability to resist tomato spotted wilt virus infection even if the plant carries the Sw-5 resistance gene that would normally combat this virus.
EDUCATION	
	Kemah E.P. Washington (Higher Education Administration) took the first-place award in the Education category for his study, *Towards a Deeper Understanding of Community College Part-Time Faculty: Perceptions of Roles and Expectations*. Recent debate on the employment of part-time faculty (PTF) among educators, policymakers, and state officials has focused more on the impact of PTF on student outcomes rather than on the experiences of PTF members. This study examines community college PTF members' perception of their roles and expectations, as well as their perceptions of the institutional environment.
	Lisa G. Hervey (Curriculum and Instruction) won second place for her work, *Between the Notion and the act: Distinctions Between Veteran Teachers' TPACK and Practice in 1:1 Settings*. Technological Pedagogical Content Knowledge (TPACK) framework studies teachers' 21st century professional knowledge and practice. This study explores the complexity that veteran teachers find in weaving educational technologies into their established instructional practices.

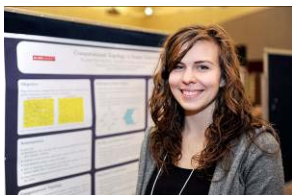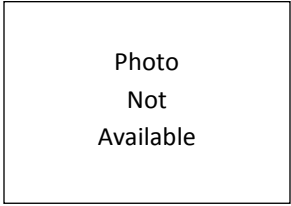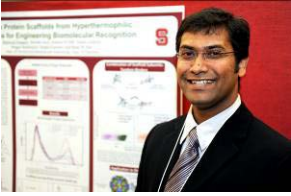|	
	Donna Hucul (Adult and Community College Education) won third place in this category with _An Exploration of Factors that Predict the Financial Literacy of Undergraduate College Students in North Carolina_. After one of this country's most serious financial crises, the topic of financial literacy has once again come to the forefront for education practitioners. The goal of this study is to establish a predictive model that provides insight into the learning process through the examination of the relationships between learners' attributes such as self-confidence, motivation, anxiety, and financial experiences, and the learners' financial literacy levels.
ENGINEERING	
	Kristen Roskov (Chemical and Biomolecular Engineering) won the first-place award in the Engineering category for _Alignment and Spatial Positioning of Ligand-Functionalized Nanoparticles in Electrospun Polymer Nano/Microfibers_. Formation of polymer nanocomposites is an increasingly attractive means to combine properties of metals and metal oxides (electrical, magnetic, optical, thermal) with those of polymers (flexible, lightweight, tough). This study examines how to controllably align and position nanoparticles and nanorods within polymer fibers to maximize the attributes of each.
	Fadi M. Jadoun (Civil Engineering) earned second place in the Engineering category for his work, _Local Calibration of the Mechanistic-Empirical Pavement Design Guide for North Carolina_. Currently, roadway pavement structures in the U.S. are built on empirical-based procedures developed in the 1950s. Significant changes in truck axle loads and configurations, tire pressure, construction practices and materials, as well as weather and subgrade soil changes, make these procedures outdated and unsuitable in different locations around the country. The main goal of this study is to recalibrate the performance prediction models in the most recent (2004) Mechanistic Empirical Pavement Design Guide software to reflect local conditions and materials.
	Jennifer Gamble (Electrical Engineering) took the third-place award for _Computational Topology in Sensor Networks_. Sensor networks consist of nodes which are spatially distributed over an area of interest, where each node can detect information about its local environment and communicate with other sensors within its radius. However, in practical applications, power is at a premium and GPS or localization algorithms can be expensive. This study explores ways in which computational topology can be used to collect features of a sensor network using only local information in a coordinate-free environment.
HUMANITIES AND DESIGN	
	Christoph Konradi, Eric Goldman, and **Matteo Rapallini** (Architecture) shared the first-place award for their presentation, _Dynamic Building Facades: A Study on the Mediation Between Double Skin Construction, Daylighting, and Design_. In 2005, buildings accounted for 38.9% of total energy consumption in the U.S., and buildings are projected to use 75% of electrical consumption by 2025. Integration of 'green' technologies into building design can greatly impact the amount energy being used. This study explores digital modeling, computer simulations, environmental data collection, and physical scale model testing to make designers better informed and able to verify design implications.
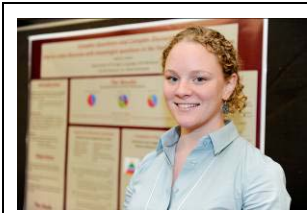
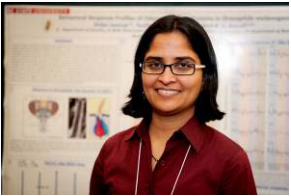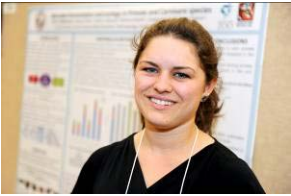|	
	Kathryn P. Bove (Foreign Languages and Literatures) won second place in the Humanities and Design category for *Complexity: How to Create Quality Discourse with Meaningful Questions in the Foreign Language Classroom*. Bridging the gap between language and content courses is an ongoing challenge. Literature courses are sometimes seen as lacking in the development of students' oral proficiency skills. This study examines how professors of foreign literature share not only their areas of expertise, but how they can advance their students' speaking proficiency.
Photo Not Available	**Sarah W. Merritt** (Communication) earned third place for her presentation entitled, *Framing Franco: Editorializing Time Newsmagazine Cover Art Through Switching to Illustration*. The use of visual media by mainstream media outlets can be a powerful guide to perception and interpretation of foreign events. *Time* magazine, one of the oldest mainstream news outlets in the U.S., has consistently directed public perception through editorialized illustration of foreign leaders. This study analyzes *Time* cover art of Spanish dictator Francisco Franco from 1937 to 1966 to determine how Franco's inner character is portrayed, how the interpretation of the art served U.S. interests at the time, and what specific message does each image convey to the viewer.
LIFE SCIENCES	
	Mahmud Hussain (Chemical and Biomolecular Engineering) was awarded first place for *Alternate Protein Scaffolds from Hyperthermophilic Organisms for Engineering Biomolecular Recognition*. This study examines ensembles of scaffold proteins from hyperthermophilic bacteria and archaea to generate stable binding proteins for a wide spectrum of targets. Based on structural data, each scaffold was used to create a 'super library' of mutant proteins. Ultimately, these protein scaffolds serve as excellent alternatives to antibodies.
	Shilpa Swarup (Genetics) won second place for her work, *Functional Dissection of Odorant Binding Protein Genes in Drosophila melanogaster*. Most organisms rely on olfaction for survival and reproduction, and the olfactory system of *Drosophila melanogaster* (fruit fly) is not only one of the best characterized chemosensory systems, but it serves as a prototype for understanding insect olfaction. Although some odorant binding proteins (OBPs) have been functionally implicated in pheronmone responses and host plant selection their functions in general odorant recognition are poorly characterized. This study examines how OBPs contribute to the insect's olfactory behavior.
	Erin McKenney (Animal Science) placed third in the Life Sciences category for *Microbial Fermentation and Ecology in Primate and Carnivore Species*. Nutrition, as preventive medicine and a foundation for good health, has great importance for health in zoo settings. And microbial populations play a key role in the digestion process of animals. This research compares the community composition and fermentation activity of gastrointestinal bacteria found in Western gorillas, common chimpanzees, Hamadryas baboons, and binturong (bearcat).

MATHEMATICAL AND PHYSICAL SCIENCES
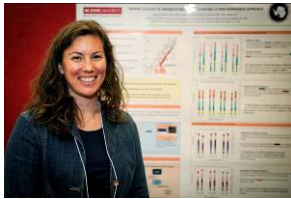
Rebecca Pirtle-Levy (Marine, Earth and Atmospheric Sciences) won first place for her poster entitled, *Trophic Ecology of Antarctic Benthic Megafauna: A Lipid Biomarker Approach*. As part of the FOODBANCS$_2$ project, fatty acid biomarkers were used to examine the diet of dominant benthic megafauna on the deep continental shelf of the western Antarctic Peninsula. The research objectives of this study were to identify fatty acid biomarkers from available benthic food sources (phytoplankton and bacteria), investigate seasonal differences in relative concentrations of fatty acid biomarkers, and identify any shifts in relative concentrations of fatty acid biomarkers from specific sources (i.e. phytoplankton) to the sediment and into benthic deposit-feeding invertebrate body tissue.


Sean F. Gallen (Marine, Earth and Atmospheric Sciences) earned second place with his work entitled, *Hillslope Response to Knickpoint Migration in the Southern Appalachians: Implications for the Evolution of Post-Orogenic Landscapes*. The southern Appalachians represent an active landscape characterized by locally high topographic relief, steep slopes, and frequent mass wasting in the absence of significant tectonic forces. The Cullasaja River basin in southwestern North Carolina provides an ideal natural setting to study landscape evolution in a post-orogenic landscape through the lens of hillslope-channel coupling. This study provides a conceptual model that explains how knickpoint migration and channel-hillslope coupling is an important factor for the maintenance of significant relief, steep slopes, and weathering-limited hillslopes.
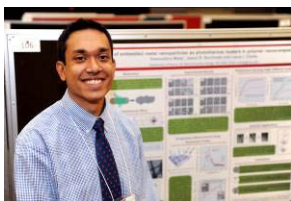
Somsubhra Maity (Physics) took third place for his work, *Use of Embedded Metal Nanoparticles as Photothermal Heaters in Polymer Nanocomposites*. Polymer composite materials have a wide variety of applications, from household items like clothing, appliances, and tires to highly specialized products such as space suit linings. However, the use of these materials requires development of novel processing strategies that will refine current uses and address needs, such as new biomedical technologies. This study investigates the use of a particular type of composite, where metallic nanoparticles are embedded in a polymer. These nanoparticles exhibit the unusual property of producing significant heat when irradiated with visible light. The process can be used for softening, melting, or bonding the plastic, and ultimately, could repair, strengthen, or intentionally thermally degrade plastic objects while in service.
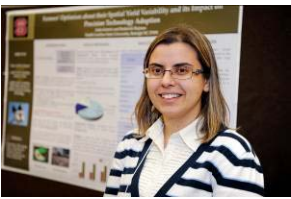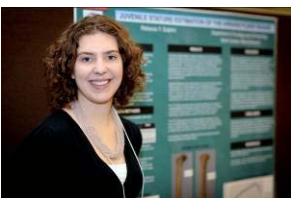
NATURAL RESOURCES
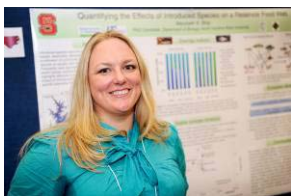
Marybeth K. Brey (Biology) won first place in the Natural Resources category for her work, *Quantifying the Effects of Introduced Species on a Reservoir Food Web*. Introduced species have the potential to alter aquatic systems through habitat destruction, declines in populations of native species, and modification in community structure. Unraveling the impacts of introduced species can be difficult. Raspberries are a high-value crop with growth potential in North Carolina and an increasing consumer market in the Eastern U.S. This study examines metabolomic variation among three red raspberry cultivars (Autumn Britten, Caroline, and Nantahala) grown in three climactic regions of North Carolina.

Tyler A. Strayhorn (Forest Biomaterials) earned second place for *Evaluating Oriented Strand Board Under Flood Conditions*. According to FEMA, there are currently no test procedures to identify and rank flood-resistant construction materials. Rather, FEMA uses guidance developed by the National Flood Insurance Program for the repair of flood damaged homes. This goal of this study is to evaluate Oriented Strand Board (engineered wood panel common in home construction) under different flood

	conditions and time intervals.
	Laurie W. Gharis (Forestry and Environmental Resources) took third place with *The Effect of Optimal Stand Level Management Regimes on Volumes of Wood and Carbon*. Forests have been identified as an important mechanism for removal of carbon dioxide and storage of carbon. Environmental policymakers need research-based decision analysis models that include not only carbon sequestration, but carbon storage in products as well. Although many researchers have developed models on global carbon management, these models do not provide guidance at an operational level. The main objective of this study is to produce an accurate and useable analytical product for Southeastern U.S. foresters growing loblolly pine (*Pinus taeda*) in the presence of a carbon market.
SOCIAL SCIENCES	
	Adrianne M. Offenbecker (Anthropology) won first place in the Social Science category with *Examining the Role of Environmental Stress in the Etiology of Skeletal Defects*. Frequencies of skeletal defects within families are noticeably elevated when compared with frequencies in the general population, suggesting a strong genetic component. This genetic predisposition may also be triggered or enhanced by environmental factors such as diet and disease. This study investigates whether environmental factors may also cause elevated levels of developmental defects within a population.
	Sofia Kotsiri (Economics) earned second place for her poster on *Farmers' Optimism about their Spatial Yield Variability and its Impact on Precision Technology Adoption*. No previously known study has focused on the role of farmers' optimism about future yield risk and its impact on technologies. This study examines how cotton farmers' perceptions about their spatial yield variability influence their decision to adopt precision farming technologies, such as yield monitors with GPS, aerial photography, grid sampling, etc.).
	Rebecca Y. Sutphin (Anthropology) took third place for her work entitled, *Juvenile Stature Estimation of the Arikara Plains Indians*. Limited analysis has been conducted for estimating stature derived from long bone lengths of juvenile skeletons. These stature estimations, while beneficial in a forensic setting, may also have applications for use as a proxy for nutritional health of past populations like adult stature. This study explores the prediction of juvenile stature of 1-17 year old Arikara Plains Indians from three burial sites spanning 1600-1832 C.E.