

Colombia-Purdue Institute

presents

**Undergraduate Research
Experience Purdue - Colombia
Research Symposium**

Monday, December 1st, 2014

9:00am - 4:30pm

Purdue University

Symposium Agenda

9:00 AM – 9:10 AM Welcome : Arvind Raman (Purdue University) and Diego Hernandez (Universidad Nacional-Bogotá)

COLLEGE OF SCIENCE

9:10 AM – 9:25 AM Laura Melissa Cruz Castro

9:25 AM – 9:45 AM UREP-C Program: Tamara Benjamin

COLLEGE OF ENGINEERING

9:45 AM – 10:00 AM Andrés Felipe Beltrán Pulido

10:00 AM – 10:15 AM Raúl Andrés Pineda Méndez

10:15 AM – 10:30 AM Camilo Alberto Duárte Córdón

10:30 AM – 10:45 AM Daniel Alejandro Jaimes González

10:45 AM – 11:00 AM *Break*

11:00 AM – 11:15 AM Daniel Ricardo González Villamizar

11:15 AM – 11:30 AM Lucía Pérez Ramírez

11:30 AM – 11:45 AM Cindy Ly Tavera Méndez

11:45 AM – 12:00 PM Nathalie Gisela Vega Ávila

12:00 PM – 1:15 PM *Lunch*

1:15 PM – 1:30 PM Ian Luke Mateus Abarka

COLLEGE OF HEALTH & HUMAN SCIENCES

1:30 PM – 1:45 PM Maroly Yohana Hermosa Gómez

COLLEGE OF AGRICULTURE

1:45 PM – 2:00 PM John Elver Jiménez Suárez

2:00 PM – 2:15 PM Juan Pablo Bonnet Toro

2:15 PM – 2:30 PM Lisseth Zubieta Hernández

2:30 PM – 2:45 PM *Break*

2:45 PM – 3:00 PM Julio César Cabra Arias

3:00 PM – 3:15 PM Andrés Mauricio Mayorga Gómez

3:15 PM – 3:30 PM Javier Leonardo Borbón Guevara

3:30 PM – 3:45 PM Ángela Patricia Romero Vergel

3:45 PM – 4:00 PM Jonatan Stivens Soto Bermeo

4:00 PM – 4:15 PM Luíś Alejandro Caballero Redondo

4:15 PM – 4:30 PM Fabian Leonardo Huertas Ayala

SAIDA MILENA DÍAZ CASTILLO

College of Science - Physics - Dr. Maxim Lyutikov

Modeling Magnetic Structures of Interplanetary Coronal Mass Ejections

Coronal mass ejections expelled by the Sun are one of the most energetic events in interplanetary space. The study of them has become a key task for the prediction of severe geomagnetic storms, which can directly affect our technological life. Here we present a theoretical study of the possible magnetic configuration of these structures while they propagate in the interplanetary medium.

WILMAR GERMAN FAJARDO MENDIETA

College of Science - Physics - Dr. Dimirtrios Giannois

Blazars Spectra: Theoretical and Numerical Modeling

A special type of Active Galactic Nuclei (AGN) are called blazars and are one of the most powerful sources at higher energies in the universe. The spectra produced by these objects are not fully understood currently due to its complexity and the lack of observational data. In this work, the main features in the spectra and the physical processes involved were shown.

LUIS EDUARDO JIMÉNEZ CUCAITA

College of Engineering - Chemical Engineering - Dr. Rakesh Agrawal

Strategies to Save Energy in Chemical Plants: Reducing the Energy Consumption in Distillation Operation

Chemical engineers transform raw materials into products to fulfill the needs of the society. Those products are produced at complex chemical plants which demand energy obtained from conventional sources such as coal and oil. There is an ever-increasing need for finding strategies to save energy and protect the environment by designing more efficient chemical processes or improving the existing ones. Among all the operations in a chemical plant, the distillation operation is the most energy-intensive. However, distillation is the preferred process for the separation and purification of mixtures in the industry. This research was focused on the separation of a mixture of light hydrocarbons, and explored all possible configurations that obtained pure products with the lowest possible energy consumption.

Research Summaries

COLLEGE OF SCIENCE

LAURA MELISSA CRUZ CASTRO

Statistics - Dr. Bruce Craig

"Best" Practices for the Analysis of a Split Plot Design with a Binary Outcome

In many experiments, the response of interest is binary (germinate/not germinate, success/failure). One needs many replications to address a binary response, but in many situations there are limitations on the number of replications possible. Due to these restrictions, one can run into estimation issues that are enhanced by a complicated experimental design. The results of this research show some possibilities to analyze a "small" split-plot design, including a Bayesian approach.

COLLEGE OF ENGINEERING

ANDRÉS FELIPE BELTRÁN PULIDO

Mechanical Engineering - Dr. Arvind Raman , Dr. James Chagdes, Dr. Howard Zelasnik

Dynamic Systems Inspired Experiments on Human-Haptic Interfaces

The research being conducted in this study is leading to the development of a reliable and accurate way to detect some types of neuromuscular disorders. This is done by using a dynamic system that could emulate the task performance of a person with a neuromuscular disorder. The goal is to understand how delays in visual information affect Fitts' Law and use this knowledge to detect slight increases in neuromuscular time delay.

RAÚL ANDRÉS PINEDA MÉNDEZ

Civil Engineering - Dr. Andrew Tarko

Screening Road Network for Intersections with Poor Safety Performance

Several different road network-screening methodologies have been applied to road networks according to transportation engineers' criteria and agencies' requests. However, the lack of research on different performance measures and network screening methodologies reduces the number of options. A simulation of a safety management process was done for Unsignalized State-Local intersections using the Indiana road network as a data base. We compared the most promising measures presented at the HSM 2010 with the measures used currently in the Center for Road Safety at Purdue University associated with INDOT. Finally, we analyzed all methodologies according to the benefit-cost ratio and total net benefit.

CAMILO ALBERTO DUÁRTE CORDÓN

Mechanical Engineering - Dr. Marisol Koslowski

Effects of Variability in the Grain Size of a Polycrystalline Thin Film Undergoing Diffusional Creep

Radio Frequency Micro-Electro-Mechanical Systems (RF MEMS) have proven to be highly beneficial in fields like satellite communication and military systems. However, RF MEMS suffer from failure mechanism such as dielectric charging, contact wear, fatigue, and creep, which have slowed its implementation in commercial systems. Moreover, grain growth during film deposition leads to columnar grains and a grain size gradient in the out-of-plane direction. The goal of this project was to predict the effect of variability of the grain size in an RF MEMS switch made of nanocrystalline nickel undergoing diffusional creep.

DANIEL ALEJANDRO JAIMES GONZÁLEZ

Chemical Engineering - Dr. Carl Laird

Optimal Booster for Response to Contamination in Large-Scale Municipal Water Distribution Systems

Water is one of the most valuable natural resources, and therefore requires careful management. In order to ensure that clean water reaches the population, water utilities need to maintain disinfectant (e.g. chlorine) concentrations throughout the distribution network. In this work we developed optimization tools to help meet this goal while also considering other objectives including minimizing total disinfectant required and penalizing large variability in disinfectant concentrations across the network. Water utilities in Colombia can greatly benefit from this work by reducing water treatment costs and improving water quality.

DANIEL RICARDO GONZÁLEZ VILLAMIZAR

Chemical Engineering - Dr. Rajamani Gounder

Hydrothermal Aging and Its Effect on Small Pore Cu Exchanged Molecular Sieves Used in NH₃-SCR

In recent years metal exchanged molecular sieves have become the most promising technology for abating NO_x pollutant emissions from lean-combustion engines to fulfill new environmental regulations that have and will continue to be adopted by industrialized regions and should be considered in developing countries as well. Since 2009, small pore copper exchanged molecular sieves have been applied industrially in light and heavy duty trucks due to their outstanding durability and catalytic activity after several cycles of heating in the presence of water. Two different types of small-pore molecular sieves have been synthesized and characterized extensively before and after a hydrothermal treatment. This simulates the conditions and life cycle of the catalysts to determine which deactivation mechanism occurs in each material.

LUÍS ALEJANDRO CABALLERO REDONDO

Entomology - Dr. Clifford Sadof

Identification of Soft Scale *Toumeyella (Hemiptera:Coccidae)* and Parasitoids in Christmas Trees

The scale insects are a very important pest in Christmas trees crops. In heavy infestations, these insects may cause leaves to discolor and drop. This reduces plant growth and vigor and may cause dieback in branches if infestations persist. In this research, we identified the scale insect (*Toumeyella pini*) and the parasitoids as a step in the Integrated Pest Management. All this information will contribute to focus the use of chemical and biological controls in future research.

FABIAN LEONARDO HUERTAS AYALA

Agronomy - Dr. Linda Lee

Persistence of Emerging Contaminants From Commercial Biosolid-Based Fertilizers in Aerobic Soils

Recent studies have detected relatively high concentrations of emerging contaminants in municipal biosolids including poly/perfluorochemicals, synthetic musk fragrances, pharmaceuticals, personal care products, and hormones. Application of these products in urban and suburban gardens and green space may therefore provide a pathway for these organic contaminants to enter the terrestrial food web and nearby ecosystems. The objective of this study was to quantify the degradation kinetics and persistence to targeted contaminants present in commercial biosolids-based fertilizers in aerobic soils.

PRESENTED IN SEPTEMBER

GONZALO AMEZQUITA CUELLAR

College of Pharmacy - Medicinal Chemistry and Molecular

Pharmacology - Dr. Val Watts

Evaluation of Coumarin and Pyrazolotriazine-Derived Compounds as Potential Modulators of Adenylyl Cyclase Subtype I Activity

The adenylyl cyclase subtype I (AC₁) has shown to be involved in several physiological processes and has recently been proposed as a novel target for the treatment of chronic pain. In consequence, the development of drugs that modulate its activity has become a topic of great importance. In the present work, the evaluation of a set of coumarin and pyrazolotriazine derived compounds was carried out by running a HTRF based cAMP accumulation assay.

different areas with variable conditions, this process is very appropriate for the Colombian natural environmental.

ANDRÉS MAURICIO MAYORGA GÓMEZ

Horticulture - Dr. Peter Hirst

Floral Commitment and Morphogenesis in Ten Apple Cultivars

The flowers in apple trees are produced from structures called buds, but many factors can affect the process to development from a vegetative bud to flower bud. One of these factors is the apple variety. In this study, we determined which of the studied cultivars have an annual and biennial crop load. The difference in the morphogenesis process in floral buds between cultivars was also investigated.

JAVIER LEONARDO BORBÓN GUEVARA

Horticulture - Dr. Michael Mickelbart

Stomatal Density Distribution in Leaves of Two Genotypes From Maize

Stomatal density (SD) on the abaxial and adaxial sides of maize were characterized within leaves 7 and 14. The leaves contained the profile for two genotypes of maize (B73 and B97) growth in the field. There were differences in SD among genotypes and locations within the leaf. B97 has higher SD than B73. In leaf 7, the SD has a lower variance and lineal decrease in B73 and B97, respectively. The SD by leaf has a lower variance from leaf 11 to 14 in B73 and B97 for both sides.

ÁNGELA PATRICIA ROMERO VERGEL

Agronomy - Dr. Sylvie Brouder, Dr. Jeff Volenec

Impacts of Potassium (K) on Crop Yield and Drought Response

This research studied how potassium (K) nutrient impacts water productivity (kg yield/kg water used), photosynthesis, and water relations of maize and sorghum in field and greenhouse conditions. Also, greenhouse gases were sampled in pastures.

JONATAN STIVENS SOTO BERMEO

Botany & Plant Pathology - Dr. Kevin Gibson

Effect of Sorghum-Sudangrass Residue Incorporation on Weed Growth and Soybean Yield

Sorghum – sudangrass is a summer cover crop used as an alternative weed management in organic production. Last year, it was planted in June and July using three different seeding rates, 0, 22.4 and 44.8 Kg ha⁻¹ of seeds. In the summer of 2014, soybeans were planted on those plots. Four samplings were conducted and soybean yield was calculated at the end of the season. Weed growth was significantly reduced by the cover crop while the soybean yield was not affected.

LUCÍA PÉREZ RAMÍREZ

Chemical Engineering - Dr. Fabio Ribeiro

Automotive NO_x Abatement by Selective Catalytic Reduction Over Copper-Exchanged Zeolites

Over the years, Selective Catalytic Reduction (SCR) has become a promising technology for the removal of nitrogen oxides (NO_x) in mobile sources. Non-noble metals like copper, iron and cerium supported Zeolites are among the most active catalysts for the urea/NH₃-SCR process. In this work, multiple Cu-exchanged zeolites were characterized and tested for SCR kinetics. Characterization techniques included x-ray diffraction, atomic absorption, temperature programmed desorption combined with a mass selective detector, thermogravimetric analysis, and UV-visible spectroscopy. Results show a comparative study between commercial and synthesized Beta zeolite.

CINDY LY TAVERA MÉNDEZ

Chemical Engineering - Dr. Rajamani Gounder

Hydrophobic Functionalization of Microporous Beta Zeolite Using Alkylsilanes

Hydrophobization of a catalyst has shown to be a suitable way to obtain a better performance in systems in which water can decrease the rate of reaction, either causing structural instability of the catalyst, inhibition or deactivation of active sites. In this project, the external surface of Ti-BEA-OH crystals, a catalyst for glucose to fructose isomerization, is modified via silanization with alkylsilanes to obtain a non-polar layer that confers hydrophobic properties to the solid. Furthermore, the kinetic effect due to the new property in the solid is studied and compared with the parent hydrophilic zeolite.

NATHALIE GISELA VEGA ÁVILA

Chemical Engineering - Dr. Fabio Ribeiro

Size and Support Effects for the Water-Gas Shift Catalysis Over Gold Nanoparticles Supported on MgO

The pursuit of alternative energy is currently one of the biggest concerns of humanity. One form of alternative energy is fuel cells, which use hydrogen to produce clean energy. The water gas shift reaction is part of the most important process to produce hydrogen from hydrocarbons. The Purdue Catalysis Center and the Universidad Nacional de Colombia worked together in the research and study of two catalysts, Au/MgO and Au/Mg(OH)₂, used in the water gas shift reaction utilizing multiple characterization methods and kinetic analysis to determine which works best.

IAN LUKE MATEUS ABARKA

Aviation Technology/Agriculture & Biological Engineering
Dr. Gozdem Kilaz, Dr. Nathan Mosier

Predicting Partition Ratios for Carbohydrate Derived Organic Acids

A study to determine the extraction capacity of organic acids derived from carbohydrates, a high added value product, was carried out. The study includes the contrast between the experimental results of three different solvents along with results obtained from software. This project is a necessary step in the recovery of organic acids from carbohydrates in the scaling up process, and its application could be extended in bio-processes involving biomass as a raw material. The extension of this study, along with recent studies in this field, could boost the treatment and use of biomass in countries rich with natural resources such as Colombia.

COLLEGE OF HEALTH & HUMAN SCIENCES

MAROLY YOHANA HERMOSA GÓMEZ

Human Development & Family Studies - Dr. German Posada
Perceptions of Change in Living Conditions and Diet Among Rural Latino Immigrants

Twenty percent of the total population of the U.S. are immigrants, and nearly 28.3% of these immigrants are from México. Due to different social and economic problems present in their countries, these people have migrated from their homeland in search of new opportunities for themselves and their families. The purpose of this study was to identify and compare perceptions of change in living conditions and diet habits of Latino immigrants from rural areas in their countries of origin to their current conditions and dietary intake. Twenty adult Latino immigrants of Mexican descent participated in the study via a semi-structure interview. The interview consisted of a set of questions and scales to examine their living conditions back in their home countries and currently in the US. Findings and implications of the study will be further discussed in the presentation.

COLLEGE OF AGRICULTURE

JOHN ELVER JIMÉNEZ SUÁREZ

Food Science - Dr. Bruce Applegate
Identification of Microorganisms Capable of Depolymerizing Proanthocyanidins Complex

Key components of rich grape skin and seed wastes are grape derived polyphenolic compounds known as proanthocyanidins (PACs). This polymeric fraction provides significant phenolic mass but is not bioavailable relative to monomers. This compositional challenge limits the potential health benefits

and commercial value of these extracts and wastes. Significant interest exists for depolymerization of these extracts and wastes by the industry to generate value added products suitable for foods and supplements. This project explores an approach of a novel method of depolymerizing these compounds using microorganisms.

JUAN PABLO BONNET TORO

Food Science - Dr. Mario Ferruzzi

Stability of Carotenoids from Biofortified Processed Maize Products

Biofortification is the process of breeding crops to be rich in bioavailable micronutrients, and is emerging as complementary strategy to combat micronutrient deficiency in developing countries. The implementation of biofortified crops rich in carotenoids targets to reduce vitamin A deficiency, and these compounds can also play a role in preventing some noncommunicable diseases. However, there are a number of stability issues in the different food processing stages that must be overcome before carotenoids can be successfully used as functional food ingredients.

LISSETH ZUBIETA HERNÁNDEZ

Horticulture - Dr. Lori Hoagland

Effect of Mycorrhizal Fungi Diversity on Soybean Under Water Stress

Previous research has found that populations of mycorrhizal fungi (AMF) are highly sensitive to agronomic management systems. However, it is still unclear how these management systems affect the functional diversity of AMF. This study aimed to compare the functional diversity of AMF from long-term organic and conventional management regimes, and how it influences yield and drought tolerance in soybeans (*Glycine max*). Impacts of drought on the mycorrhizal community were determined in a greenhouse trial using inoculum derived from field plots, modified Hoagland's nutrient solution, an automated watering system, leaf water potential, and stomatal conductance. Preliminary results indicate that AMF diversity is greater in soils from organic treatments, and plants in organic treatments are more tolerant to water stress.

JULIO CÉSAR CABRA ÁRIAS

Entomology - Dr. Jeff Holland

Bioindicators of Pollinator Community Collapse

Habitat fragmentation and environmental disturbance are some of the main causes of loss of diversity in pollinator communities. As part of the Hardwood Ecosystem Experiment, four types of beetle traps were deployed in nine different locations at Yellowwood State Forest. Each unit recovered sample information from landscapes with different levels of environmental disturbance. After a complete identification process and statistical data analysis, long-horned beetles were used as biological indicators of the ecosystem conditions. Since the overall research model could be applied in