

The Colombia Purdue Institute (CPI) Presents
The Undergraduate Research Experience
Purdue-Colombia (UREP-C)

Final Symposium

December 2, 2016

Purdue University



Andrés Felipe Salazar Chaparro: Dr. Vincent Jo Davisson, Medical Chemistry and Molecular Pharmacology

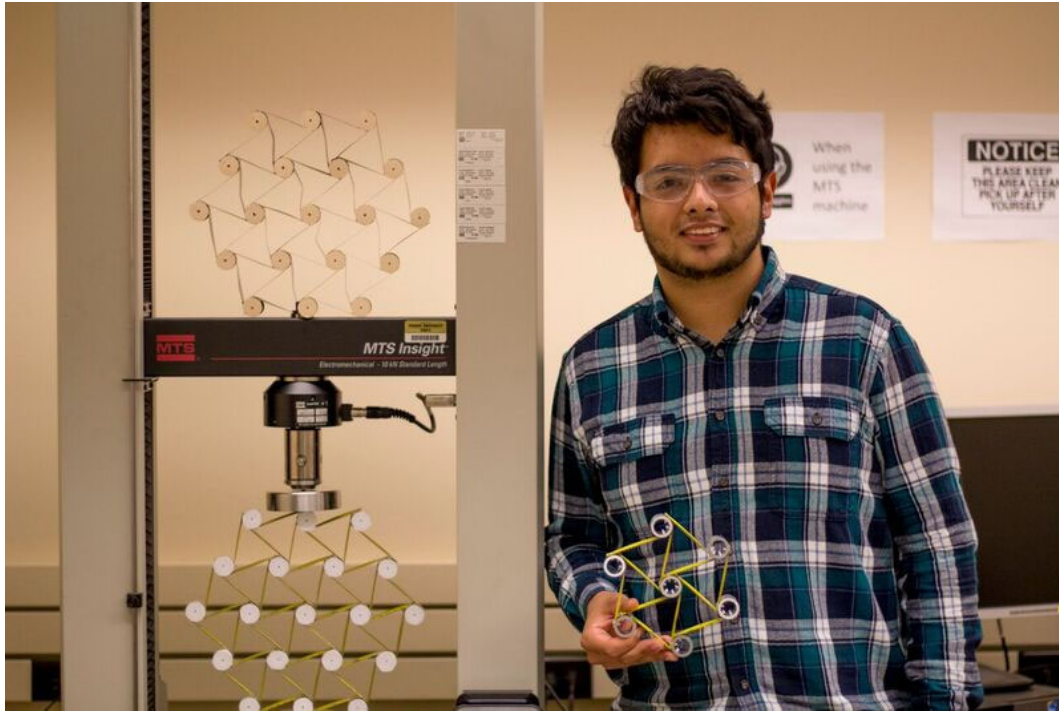
Fragment discovery for nuclear protein-protein interaction hotspots



The use of chemotherapeutic agents that target DNA damage have been a major part of the oncology for many years. However, the general toxicities and lack of efficacy for many types of resistant tumors motivates new molecularly-targeted approaches to therapy. Due to this, new therapeutic agents are emerging based on the understanding of tumor dependencies on DNA repair pathways. Recent evidence shows that the Proliferating Cell Nuclear Antigen protein (PCNA) plays a key role in multiple cellular processes such as DNA replication, chromatin remodeling, DNA repair and cell cycle control. The understanding of how this protein is tightly associated with the cancer transformation process has made this protein an interesting target due to its possible therapeutic application. Here at Purdue I've been working on fragment Discovery for PCNA/PIP-box protein-protein interactions as a cancer research project with Dr. Vincent Jo Davisson.

Cristian Andrés Tejedor Bonilla: Dr. Pablo Zavattieri, Civil Engineering

Phase transforming cellular materials for energy dissipation



The development of materials with energy absorption capabilities for creating protection devices takes great importance in the preservation of infrastructures, daily-use objects and even living bodies. The mechanical behavior of cellular materials depends mainly on the mechanical properties of the elastic base material from which it is made, in addition to its geometrical and topological features. Thus, the new cellular material in which I am working on is made from bistable curved ligaments (steel measuring tape) over three different geometrical design with chiral characteristics. Also, flat ligaments are used over the same designs to compare the mechanical behavior of both cellular materials. This experience has been an academic challenge owing the fact that all my research experience before had been developed primarily in geotechnical engineering. However, I have found this area of knowledge as a really interesting topic to go on learning and contributing. I feel really thankful for this academic, cultural and personal experience.

Daniel Camilo Tolosa Villareal: Dr. Giulio Caviglia, Mathematics

Gröbner Bases: Stillman's Conjecture and F5 algorithms



I developed a never ending curiosity about what surrounded me at an early age, but soon I discovered that some of the most fascinating creations of man lied within, not outside the human mind. Ideas then caught my attention, along with the realization that throughout history, mathematics (& philosophy & art) have been shaping the architecture of the imaginary. As time went by, a goal started to materialize, a goal as simple in its formulation as it is difficult to achieve: to contribute to this vast labyrinth of ideas.

This experience at Purdue University College of Science has brought me closer to my goal than ever before: I have had the opportunity to see first hand how researchers work, striving to create knowledge.

Gröbner Bases have been the focus of my research. Recent developments, namely the creation and improvement of an efficient family of algorithms known as F5, have bolstered the mathematical community's interest in the subject.

Daniela Castellanos Reyes: Dr. Marcia Gentry and Dr. Nielsen Pereira, Educational Studies

Gifted education strategies in regular classrooms: Teaching practices in high schools of Bogotá, Colombia



When I was a little girl, my hero was Robert Langdon, the main character of Dan Brown's thriller movies. I wanted to solve mystery cases all around the world using my brains. So, I decided that being a scholar was a nice thing to do. Then, I decided that I wanted to do it in English, because that was how Dr Langdon solved cases. So, I did. Nineteen years later, I am showing the results of a non-stop persecution from deadlines, IRB committees, research meetings and rings under my eyes. I have not finished. I have not saved the world like Robert. Yet. Nonetheless, using knowledge as weapon against evil had taken me to strange territories, to make little families here and there and define my passion. Maybe I will not save the world through academy, but I might save some potential gifted Roberts. Soon to be a major motion picture.

David Eduardo Murcia Lesmes: Dr. Connie Weaver, Food Science

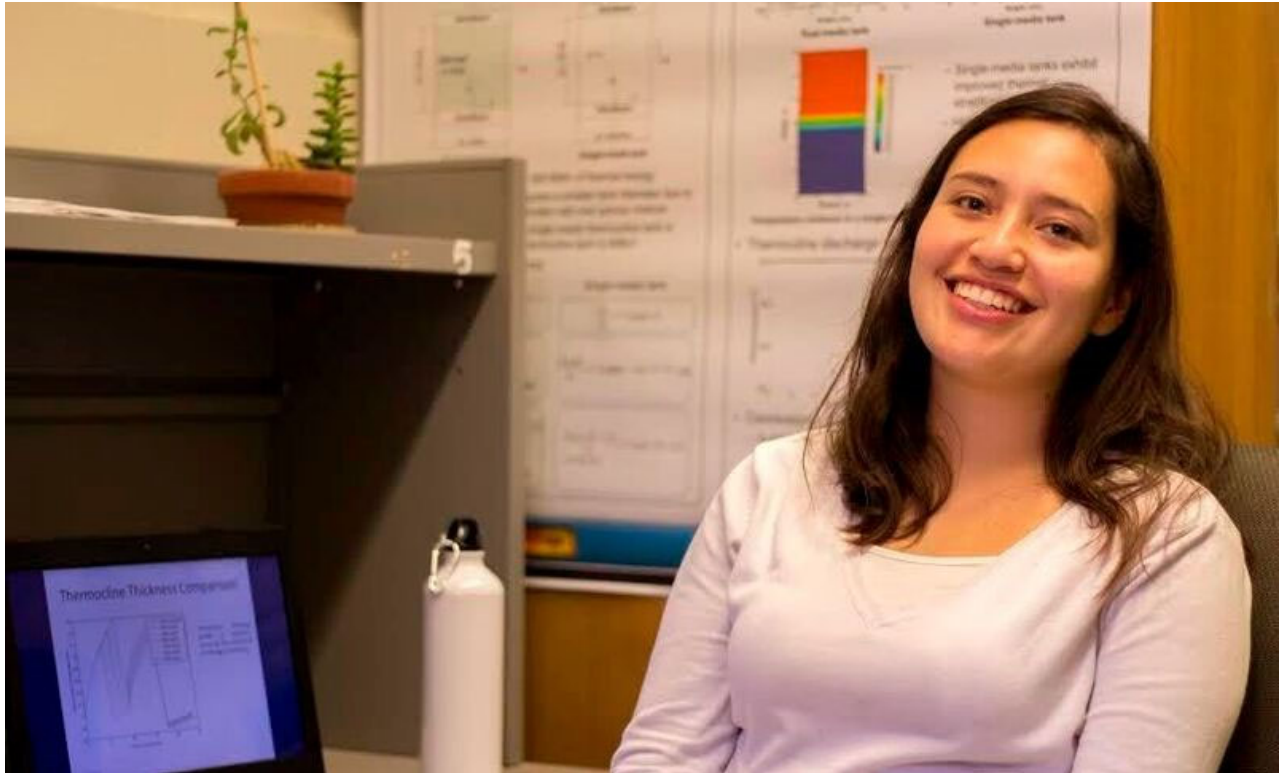
Bioaccessibility of blueberry phenolic compounds after food processing



As I child I had a curiosity about where food goes after the digestion process and why it is importance to have a healthy diet. Being a food scientist so that I may develop new and innovative healthy food products has been one of my long-time interests. I am a nutrition and dietetics student with major in food science. My main focus at Purdue University has been in foods for health. I have been trained in conducting animal studies and clinical human studies, as well as food analysis and in-vitro digestion models to characterize food constituents - in this case the bioactive compounds polyphenols. Polyphenols are phytochemicals present in high concentrations in berries, well known for their high antioxidant properties. My research has been with blueberries and their possible role in bone health in postmenopausal women.

Dayana Stefany Vega Latorre: Dr. Suresh Garimella, Mechanical Engineering

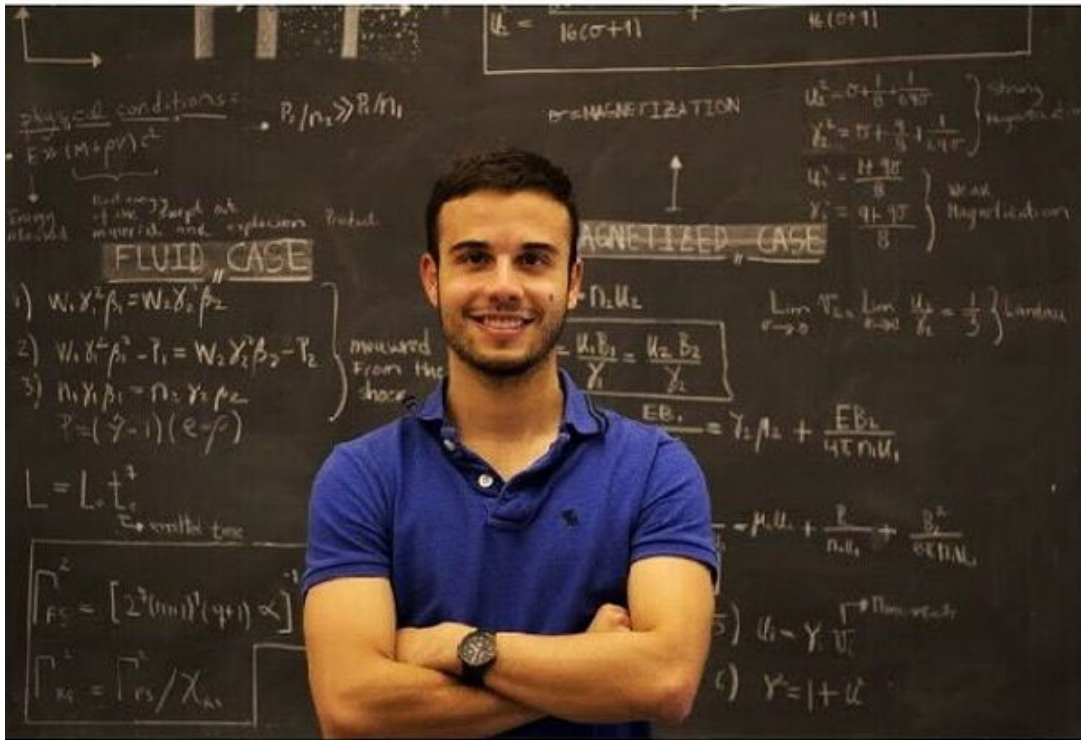
Analysis of thermocline tanks performance under interrupted operation due to short transients in solar energy availability in CSP plants



As a student of B.E. in Mechanical Engineering, my interests in heat transfer and thermodynamics carried me to work in sustainable systems for power generation. During the last months, I have been doing my internship under the guidance of Dr. Weibel and Dr. Garimella, associate director and center director of the CTRC (Cooling technologies Research Center) at Purdue University. During my internship, I have been studying the performance deterioration in thermocline tanks due to the interrupted operation with fast toggling caused by cloudy transients. Thermocline tanks are thermal energy storage devices that allow CSP (Concentrated Solar Power) plants to continue operation even without available solar radiation, also are cost effective alternative to conventional thermal energy storage systems in Solar Power Generation. My stay at Purdue has increased my interests on sustainable systems and heat transfer applications.

Juan Camilo Jaramillo Gómez: Dr. Maxim Lyutikov, Physics and Astronomy

GRB X-ray afterglows from the termination shock of long-lasting wind

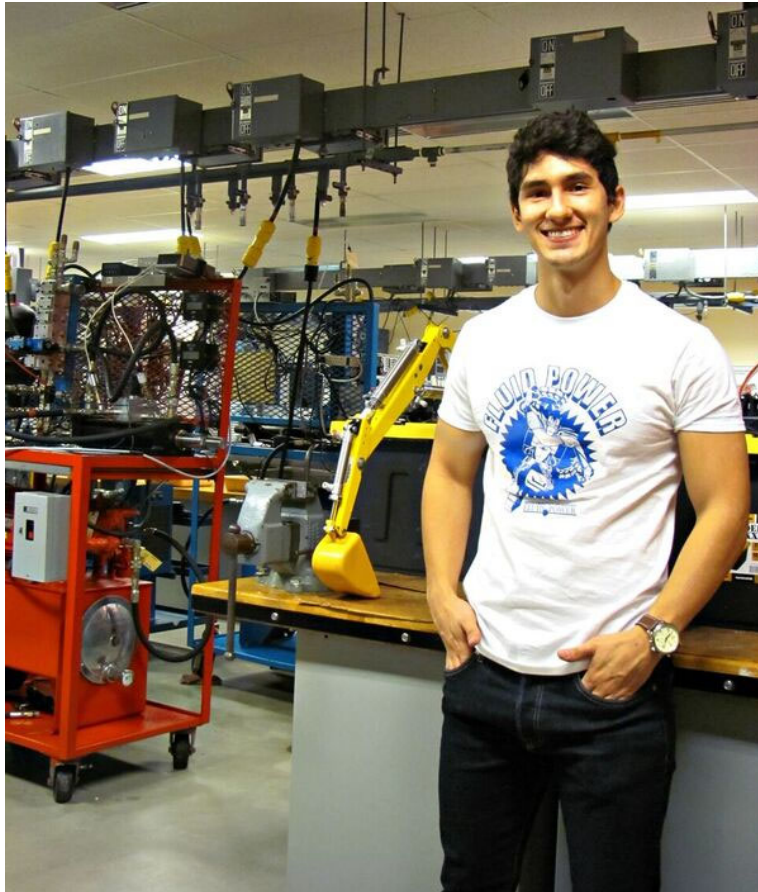


During my stay at Purdue I worked on “GRB X-ray afterglows from the termination shock of long-lasting wind”. In this work we develop a model of early GRB afterglows with dominant X-ray contribution from the reverse shock in highly relativistic magnetized wind produced by a long-lasting central engine. Specifically, we explain how the reverse shock emission in the X-rays and combined forward shock and reverse shock emission in the optical can explain many puzzling properties of early GRB afterglows.

Being at Purdue has taught me how many different ideas, coming from different backgrounds, can converge to make amazing stuff. Perhaps I do not know where all this is leading me, but surely it has let me realize how far I can go through my ideas.

Juan David Rodríguez Gómez: Dr. Jose M. García, School of Engineering Technology

Promoting the use of fluid power with the design and construction of an excavator robotic arm wireless controlled



As a senior student of Mechatronics engineering at Universidad Nacional de Colombia, and working hand in hand with my advisor at Purdue PhD Jose Manuel García, we developed a project called: Promoting the use of fluid power with the design and construction of an excavator robotic arm wireless controlled. The project sought to develop a robot that imitates the movement of an excavator, as a demonstrating tool to show a real application of fluid power systems specially dedicated to kids. This research experience has been for me the opportunity to widen my academic horizon, to work with different people, to learn about different cultures, and also to know how to overcome challenges and research difficulties. I am very happy to have been a part of this program.

Juan Diego Mejía Becerra: Dr. Hao Zhang, Statistics

On the asymptotic properties of the empirical functional principal components for spatial data analysis



I am a member of the “Spatial Statistics Research Group” at National University of Colombia in Bogotá, Colombia. I am a statistician double majoring with mathematics. I have always admired people whose decisions can change the world. I find in statistics a tool that helps people to make the right informed decisions and to find beautiful patterns in data. My research interests are: probability theory, stochastic process, spatial statistics and machine learning.

In recent years, technology has allowed experts from different fields to gather big amounts of data. In many disciplines, these data can be described naturally as functions. This is one of the main reasons why functional data analysis has experienced a large development. One of the main challenges for functional data analysis is the development of statistical methods for the analysis of spatially correlated curves. During my stay at Purdue University I worked towards this goal finding asymptotic results for a specific methodology that uses functional principal components.

Juan Pablo Jáuregui Lozano: Dr. Andy Tao, Biochemist

Identification of two possible substrates of protein kinase CDKL5



I am a biology undergraduate student and my project is called “Identification of two possible substrates of protein kinase CDKL5”. When a protein kinase phosphorylates its protein substrates, the substrate activity gets whether up- or down-regulated. The CDKL5 syndrome, that causes early onset seizures and severe neuro-developmental impairment, is a disease where the CDKL5 gene mutates and these mutations can lead to disruptions on the phosphorylation of its substrates. I am interested in properly identifying if CDKL5 is the kinase that directly phosphorylates VGF and AUP1, both proteins that may have an important role in normal neuronal functions. Coming to Purdue for this once in a lifetime experience has definitely changed my life in a positive way and I am so thankful for all the amazing things I had the chance to learn and the amazing people I’ve got to meet as well.

Julián Andrés Velásquez Carvajal: Dr. Ronald Turco, Agronomy

Effect of fertilization on soil bacterial communities using DGGE



My area of interest includes plant-soil-water interactions and their relevance in agricultural systems. Right now, I am trying to understand soil microorganism's dynamics in response to fertilization using molecular techniques. I feel great working at Purdue, a university founded on agricultural principles where crop, plant, entomology, horticulture and soil sciences adopt brand new technologies towards the deepest understanding of modern agricultural systems. This experience have helped me to improve as a researcher and it has also enriched my cultural background. Undoubtedly, I want to come back as a PhD student working in a project related to food production and sustainability.

I want to acknowledge my advisor, Dr. Ronald Turco and Marianne Bischoff Gray for their unconditional support.

Julian Santiago Otero Moreno: Dr. James Ogg, Earth Atmospheric Planetary Science

The TimeScale Creator visualization of Colombia and Ecuador's petroleum systems and the Stable Isotope Analysis of a source rock in the upper Cretaceous



My project consisted on analyzing 5 samples of The Guaduas Formation for Carbon and Oxygen Stable Isotopes, an innovative way to understand the geological past by using changes in the general temperature of the world and comparing this with other geological record to correlate any anomalies worldwide. This research experience has been a highlight in my academic career because it gave me the opportunity to learn and apply my geology knowledge. This research involved a very difficult processing of the samples and interpretation that could only be accomplished with the help of Dr. Darryl Granger, Dr. James Ogg, Dr. Susana Salazar and Dr. Pedro Patarroyo. Now as a Geologist I have great expectations of my professional career and I look forward to keep unraveling the mysteries of the past.

Laura Alejandra Beltrán Daza: Dr. Marty Frisbee, Earth Atmospheric Planetary Science

Quantifying Streamflow Generation in the El Rito watershed in northern New Mexico using EMMA



Groundwater represents 30% of the fresh water in the world, which is why hydrogeology studies the spatio-temporal dynamics of this resource, my interest in this topic arises in my attempt to understand the distribution and movement of this natural source. I have been working with Dr. Marty Frisbee in the Ground Water/Surface Water Interactions group in the Earth, Atmospheric and Planetary Sciences department. My research interests are focused on identifying and quantifying source waters in the El Rito watershed in northern New Mexico using geochemical and environmental tracers, by applying End-Member Mixing Analysis. This valuable experience and the insight gained up to this moment, will provide the necessary impetus to establish myself in a career in science.

Laura Camila Niño Corredor: Dr. Nadia Gkritza, Civil Engineering

Energy consumption and emissions due to public transportation. A comparison between Colombia and the United States



Transportation has become in one of the most important variables to plan a sustainable city. Regarding the environmental externalities that the transportation has, In my project “Energy Consumption and Emissions due to Public Transportation. A Comparison between Colombia and the United States”, I am developing indicators related with the energy consumption and emissions due to public transportation in the United States and in Colombia in order to propose strategies that beneficiate and decrease the transportation externalities in both countries. To achieve my research goal, I am working with Dr Nadia Gkritza, faculty of Sustainable Transportation Systems Research Group at Purdue University and professor William Castro, director of Programa de Investigación de Tránsito y Transporte at Universidad Nacional de Colombia. I am thankful with this UREP-C experience because give me the opportunity to face a research environment and has motivated me to keep working on the best way to implement a sustainable transportation system in my country.

Luis Enrique Garzón Sabogal: Dr. Maria Caterina Santagata, Civil Engineering

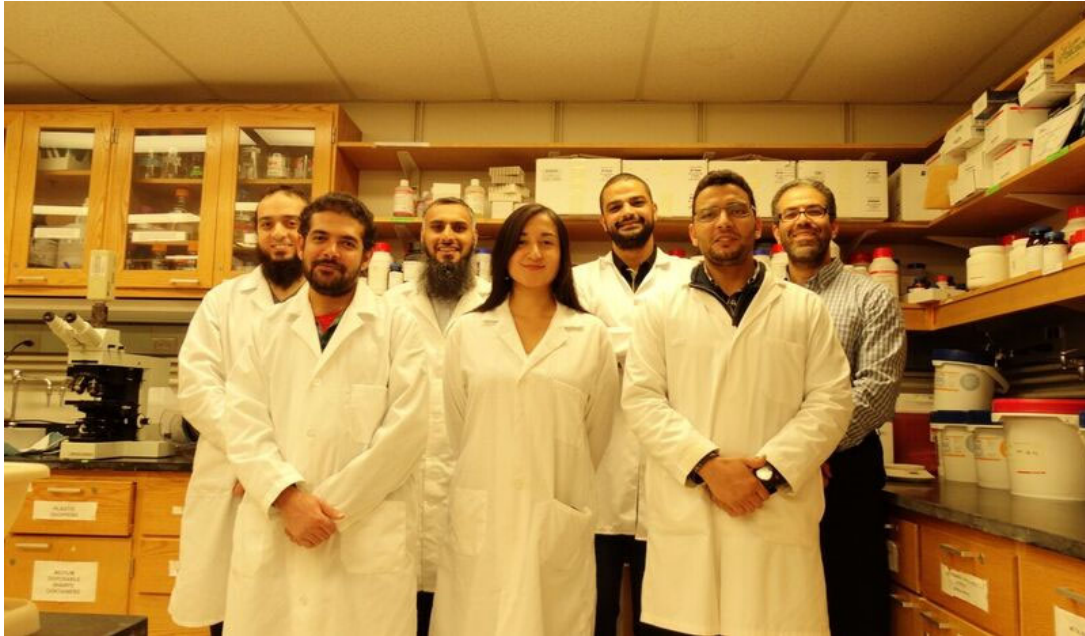
Preparation and evaluation of Resonant Column and Cyclic Triaxial test apparatuses



Motivated by previous research projects on modification of granular soils and the mitigation of liquefaction, I got interested on the testing procedures involved in the description of the soil's behavior under different excitation conditions (vibrations). Through my experience at the Lyles School of Civil Engineering I have been involved deeply with the practical and theoretical foundations on the resonant column and the cyclic triaxial tests. Now I am able to identify problems and generate solutions around these devices, both of them usually considered in Colombia as black boxes. This program and the advice of professor Marika Santagata have given me the opportunity to understand far more the geotechnics field, it has also inspired me to intervene similar apparatuses in Colombia and to improve the methods used on the soil mechanics education.

Mónica Liliana Vargas Ardila: Dr. Mohamed Seleem, Comparative Pathobiology

Old drugs for bad bugs: Repurposing non-antibacterial drugs for treatment of methicillin-resistant *Staphylococcus pseudintermedius* (MRSP) infections in companion animals



I am a Veterinary student at Universidad Nacional de Colombia, and I am doing my research internship in the Laboratory of Dr. Seleem in the Department of Comparative Pathobiology at Purdue. As the focus of this lab is antimicrobial drug discovery and my main interest is public health, I have been participating in a research project about identification of novel drugs that can be repurposed as therapeutic agents for treatment of *Staphylococcus pseudintermedius* infections, a leading cause of skin and ear diseases in companion animals and also of some sporadic human infections acquired primarily from dogs (zoonotic potential). Being at Purdue has been a wonderful experience, I am very pleased with all I have learnt and very grateful to all those who have shared this experience with me.

Rathziel Roncancio Reyes: Dr. Jay Gore, Aeronautics and Astronautics, Mechanical Engineering

Experimental study of CO₂ biomass gasification using iron as catalyst under high-pressure environment



CO₂ biomass gasification is a clean CO₂ recycling method that produces energy and biofuels, nonetheless, this technology is energy intensive and requires high temperatures to achieve the reaction between carbon and carbon dioxide. Hence, my research at Purdue University has focused on achieving a higher gasification rate in the gasification of biomass using pressure as key parameter, in this study case corn stover has been selected as biomass and iron has been chosen as catalyst for the reaction $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$.

Furthermore, my learning at Purdue has not only been limited to strictly academic matter, the whole experience of being immersed in a new culture has been nourishing for me and at the same time has broadened my interests and horizons. Nowadays, my research interests are in the study of renewable energies, combustion and reacting flows.

Tatiana Padilla Barrero: Dr. Bryan Hubbard and Dr. James Jenkins, School of Construction Management Technology

Study of the risk factors that caused fatal injuries in the construction industry in United States from 1994 to 2014



I am a civil engineering student and my areas of interest are alternative materials, green transportation and occupational safety and health in the construction industry. Currently I am working on safety in the construction industry, developing a research project named: Study of the Risk Factors that Caused Fatal Injuries in the Construction Industry in United States from 1994 to 2014. The objective of this research is to identify which are the States that do not follow the standard national statistics and need different safety measure by analyzing the factors that have caused most of the fatalities in the construction industry during the last two decades in each State. The UREP-C program has mean to me an extraordinary opportunity of living and experimenting the grad student's environment and allowed me to have a clearer mind at the time of choosing the next step after finishing my mayor next year.

Wilson Enrique Amaya Muñoz: Dr. Jonathan Bauchet and Dr. David Evans, Consumer Science

Bankruptcy determinants among U.S. households during the peak of the great recession



My stay at Purdue University has meant to me a personal and academic growth without precedents in my life as I have had the opportunity to work very closely with top researchers and a diverse international community. Regarding our research, we explored the dynamics and patterns of household bankruptcy phenomenon in the U.S during the Great Recession of 2007. Firstly, a broad literature review concerning household overindebtedness factors was made having in mind the last financial turmoil period, then we extracted the most important bankruptcy causes. Based on this, a logistic regression model was employed to quantify the incidence of each cause on bankruptcy as well as descriptive statistics. I want to thank all the people that made this experience possible and the ones that contribute to make this learning journey the best one I have ever had.

Yeison Rueda Pineda: Dr. Patricia Hart, School of Interdisciplinary Studies

Time with a state park



A slideshow made to be part of the launch of the book: *A Place Called Turkey Run*, a book about Indiana's Second State Park. It's an audio-visual piece that was meant to run as a background on a room, showing a selected group of pictures from the book looking to call the public attention but mainly to change between images on an imperceptible way. All this was binded with sounds from the park according to the images, which finally aimed to create an immersive ambience for the public assisting the meeting.

Being part of this work allowed me to know what a State Park has to offer, it's importance as a place to be in touch with nature and valuable people efforts through history to open people's mind towards the real importance of nature preservation