UREP-C 2021-II

FINAL SYMPOSIUM

About UREP - C

UREP-C is a program aimed at undergraduate students at the Universidad Nacional de Colombia, which focuses on providing individual research internships of six months at Purdue University. Currently, this program is addressed to undergraduate students from any area of knowledge at the Universidad Nacional de Colombia, who are motivated to be part of a research project.

Students participating in the program have access to a stay with specialized study groups at the West Lafayette Campus of Purdue University in Indiana, USA. They are accompanied by an outstanding academic from the U.S. institution, who takes on the role of mentor and provides the necessary tools to carry out the project, and another, from Colombia, who monitors the progress of the work.

The projects carried out in the program cover all areas of knowledge and study problems of interest to the countries. This program is an opportunity to strengthen research in Colombia with an international focus; through this alliance between Purdue University, the National University of Colombia and the student, this unique experience of international mobility is made possible, which generates transformative projects, increases the quality of education in the country and makes social inclusion a reality.

The program has been directed to students from the Bogotá campus and recently students from the Medellín campus. UREP-C continues to expand in order to provide this opportunity to more students. Now it is also directed to PEAMA (Special Program for Admission and Academic Mobility) and graduate students from the Bogotá campus.

Medellín

Purdue University, on behalf of its College of Engineering, and Universidad Nacional de Colombia campus Medellín desire to enrich their perspective academic and research programs, to strengthen and expand the mutual contacts between both Universities. In order to achieve these goals the parties wish to implement an undergraduate student research visitor program (the "UREP-C Program"), thanks to the call of the Vice-Deanship of Research and Extension (VIE), - Women Scientists - UREPC (Undergraduate Research Experience Purdue Colombia). This program is offered to female engineering students with the aim to promote gender equity and broader involvement in research activities and academic careers.

About SURF - UniAndes

In 2003 Purdue's College of Engineering launched the Summer Undergraduate Research Fellowship (SURF) program. The purpose was to offer undergraduate students an experience that would enhance classroom learning, involve them in real problem solving scenarios, and spark their interest in research careers in science and engineering. A small group of undergraduates from Universidad de los Andes (Uniandes) in Colombia was granted the opportunity to join the SURF program.

Purdue's strategic involvement in Colombia caught Uniandes' attention, as SURF students are paired with professors and graduate student mentors to work on interdisciplinary research projects. The Colombian students acknowledged the effort made by the SURF Program staff to also create plenty of opportunities for socializing, networking, and enjoying fun activities during their stay.

We expect that many more successful stories will derive from this fruitful collaboration.

Managing Director - Colombia Purdue Partnership

Juan Diego Velasquez joined the Office of Global Partnerships in 2018 and currently serves as the Managing Director of the Colombia Purdue Partnership. He is a connector of people, a builder of strong relationships, a dedicated facilitator of partnerships, and an innovator of programs that reach across the university and across Colombia. He is passionate about bringing Purdue to Colombia and Colombia to Purdue. He currently assists the Colombian Student Association at Purdue and is the academic advisor for the Society of Hispanic Professional Engineers.

Juan Diego Velasquez has been an essential part of this program. Not only in the academic field but for the human labor to us. We want to say thank you because of the incredible work he has been doing with the UREP-C program, which has been developing our research and human capabilities. With your support, it has been possible to develop and strengthen a research network by promoting Colombian talent throughout Purdue University.

Contents

Juan Felipe Alvarez Guevara
Nursing

COLLEGE OF HEALTH AND HUMAN SCIENCES
Department of Public Health

Purdue advisor: Dr. Yumary Ruiz
UN advisor: Dr. Sonia Carreño

Health and wellbeing of Latinx youth in farm worker/agricultural worker families

During my research stay at Purdue University I had the opportunity to work over the guidance of Dr. Yumary Ruiz with the Purdue Puentes Project which is a longitudinal five-year research study that aims to learn about the well-being, stressors, challenges and strengths of Latinx youth ages 10-15 in farmworker and agricultural families. In addition, it seeks to identify resilience factors that promote success and help youth to overcome challenges and adversity.

I took part in a number of duties including data collection with youth and families, recruitment and outreach efforts, communicating with enrolled families, transcribing Spanish youth and mom interviews, and assisting in administrative lab tasks. Apart from that, I did some preliminary analysis of quantitative data using descriptive statistics.

After being here I became even more convinced that I want to dedicate myself to public health and thus combat those social and health disparities that distance communities from the majority of opportunities that many people already have. I hope to contribute with this experience to future social and health projects that I join in Colombia.

Thank you UREP-C for such an enriching experience!

Angela Maria Lasso Jiménez
Political Science

COLLEGE OF LIBERAL ARTS
Department of Communication

Purdue advisor: Dr. Josh Boyd
UN advisor: Dr. Leopoldo Múnera

Sport is not neutral. A comparison of gender inequalities in Colombian and American women's basketball leagues in 2021.

I am a Latin American feminist woman who has been playing basketball for more than half of my life. And I am also a Political Science student who is really interested in gender and sports. That is why I decided to mix two of my biggest passions —basketball and feminism— during my time at Purdue. For that reason, I compared the gender inequalities that exist in the women's highest basketball leagues in Colombia (LSBF) and the United States (WNBA). This research makes two social and political dimensions visible. First, it shows the discrimination and the way in which the media invisibilize the precarization at work daily experienced by female basketball players. Second, it questions the way in which women players are called professionals but they are not treated like that. Lastly, my UREP-C experience was more than academically significant. Here, I built a family with my roommates and closest friends who loved me and supported me when I needed it. The adulting challenges that we faced together and the overcoming periods of anxiety made me growth as a person. But also, the time playing in the snow, partying hard, cooking like a team, and watching scary movies, made this experience one of the best of my life.

Karen Lorena Gutierrez Parra
Pharmacy

COLLEGE OF PHARMACY
Department of Industrial and Physical Pharmacy
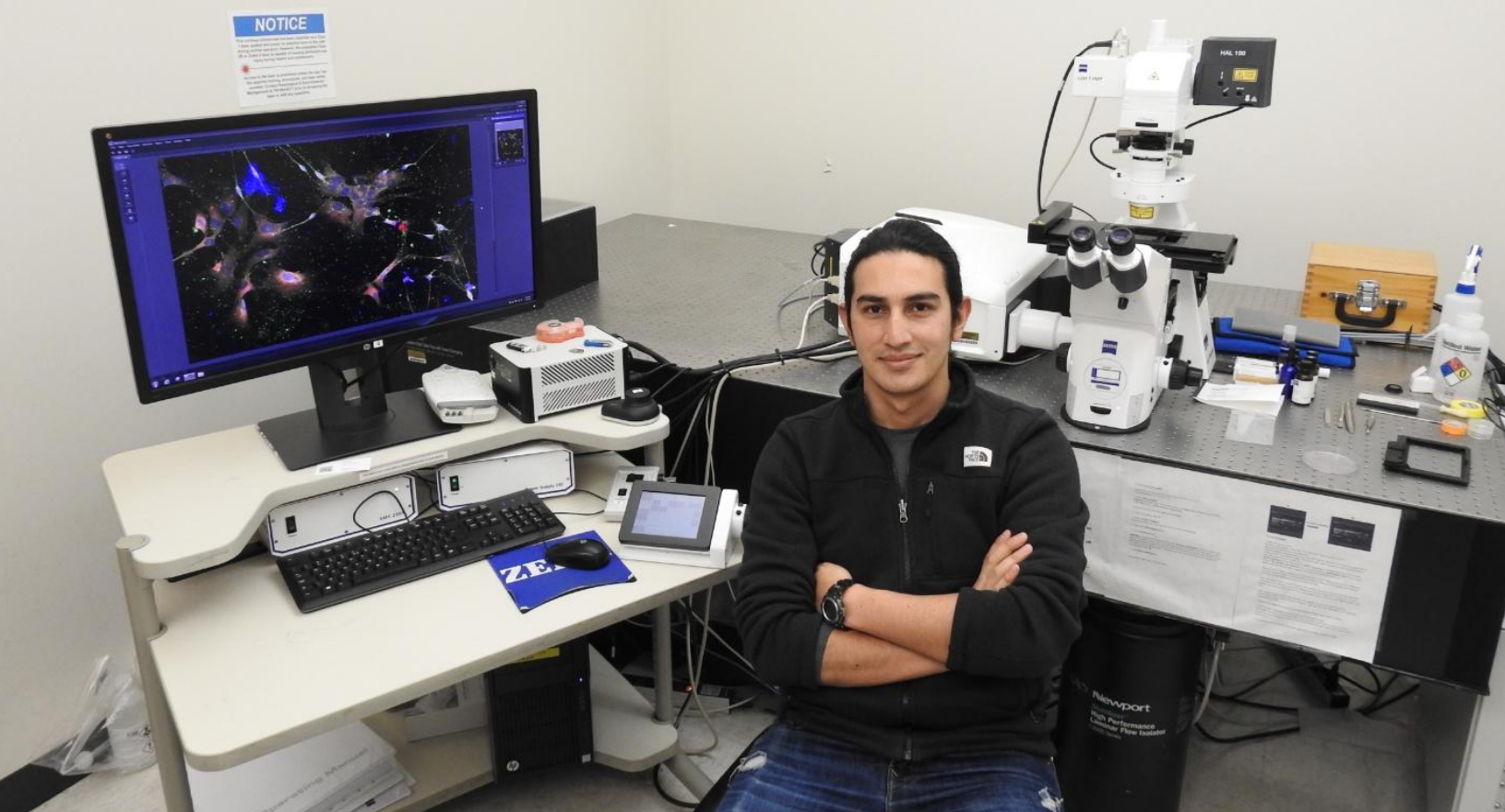
Purdue advisor: Dr. Yoon Yeo
UN advisor: Dr. Claudio Gomez Alegria

Development of Polyphenol Polymyxin B Nanoparticles for sepsis treatment

Sepsis and septic shock are life-threatening conditions involving severe systemic inflammatory responses to infection. Currently, sepsis is treated by broad-spectrum antibiotics, fluid resuscitation, and vasopressors, aiming to manage early infections and support end-organ functions. However, the high mortality rate and the lack of success in recent drug development efforts point to a critical unmet need for effective medical intervention in sepsis treatment.

During my experience in the UREP-C program, I worked for Dr. Yoon Yeo's research group. I contributed to the development and characterization of Polyphenol-Polyximib nanoparticles (NPs') for sepsis treatment by performing drug loading measurements using High-Performance Liquid Chromatography and size and surface charge measurements by Dynamic Light Scattering. I also conducted a cell study to assess the NPs' performance at the cellular level through SEAP assay on THP1-XBLUE-MD2-CD14 reporter cells.

I am grateful to the National University of Colombia and Purdue University for giving me this awesome opportunity. This experience was challenging but it has brought not only significant academic growth but also gave me a cultural exchange and the inspiration to pursue a Ph.D. in the Department of Industrial and Physical Pharmacy.

Jhon Edison Martínez Ramírez
Master - Pharmacology

COLLEGE OF VETERINARY MEDICINE
Department of Basic Medical Sciences

Purdue advisor: Dr. Riyi Shi
UN advisor: Dr. Mario Francisco Guerrero Pabón

In Vitro Study of traumatic brain injury using neurons grown on microelectrode array (MEAs)

The Center for Paralysis Research (CPR) investigates innovative ways to solve problems of the nervous system and welcomes ideas that challenge traditional dogma. It is an interdisciplinary basic sciences and neuroengineering group located within Purdue College of Veterinary Medicine. The laboratory has two signature research areas: spinal cord injury and traumatic brain injury (TBI). With these two areas, CPR seeks to improve quality of life for those afflicted with neurological trauma and diseases through diligent research into the intricacies of the brain.

My internship position at the CPR focused around the development of a novel in vitro model of trauma, colloquially referred to as "TBI-on-a-Chip". This device allows for simultaneous morphological and electrophysiological monitoring of neuronal networks grown on microelectrode arrays during impact injuries of clinically relevant forces.

This internship has given me an opportunity to combine my veterinary training and background in medical/pharmaceutical research with exciting new Biomedical Engineering technologies. In addition, it has also contributed to my personal development by allowing me to experience a new culture and meet other students from all over the world. That is why I am very grateful to the National University of Colombia, CPR, and the UREP-C program.

Shelly Valentina González Ballesteros
Economics

KRANNERT SCHOOL OF MANAGEMENT
Department of Management

Purdue advisor: Dr. Ben McCartney & Dr. Sergiy Chernenko
UN advisor: Dr. Leonardo Urrea

Interactions between political affiliation and financial decisions.

At Purdue, I was engaged in two different projects. The first one relates the level of political extremism in United States' states with their level of protection, in this sense, it aims to identify if a higher level of political extremism is correlated with less financial forgiveness. The second one seeks if political views and affiliation of managers of municipal bond mutual funds may affect their investment decisions, specifically whether they exhibit a bias in purchasing bonds.

In both projects, my work consists of data management, data visualization, and descriptive analysis. This work has enhanced my programming abilities, especially in Python and Stata, and gave me the opportunity of connecting with the latest research ideas in this field.

Additionally, I was able to do a literature review on credit markets in developing countries, which allowed me to learn about a field I was not very close to before coming and that, currently, plays a crucial role in economics research.

After this experience, I made friends, I met a new culture and I got inspired by the beauty of the campus, the college, and the way people work here. In the end, this made me realize that I would like to continue through an academic path.

Thank you UREP-C!

Hernán David Moreno Rueda
Mechatronics engineering

POLYTECHNIC INSTITUTE
Department of Engineering Technology

Purdue advisor: Dr. Brittany Newell
UN advisor: Dr. Fernando José Mesa

Engineering for Little Explorers

This project focuses on designing the prototype of a low-cost car for babies with disabilities. This prototype then will be replicated by freshman students who, at the same time, will learn about project managing and teamwork. The design of the first prototype started with a commercial electric baby car, and some features such as backrest, footrest, single joystick control have been implemented. Also, electronics and control have been developed using the Arduino platform.

The process of design and manufacturing has been both challenging and enriching, available resources at the lab contribute to trying different ideas, while Colombian Ph.D. students at the lab have helped to improve solutions and get familiar with the research field.

Living the UREP-C experience is challenging, being more independent and adapting to the US culture are some examples. However, sharing with my UREP-C colleagues has made this process to be way pleasant. Plus, I have met locals who have been very charming and open to international students.

Gabriel Octavio Lozano Pinzon
Computer Science

COLLEGE OF SCIENCE
Department of Statistics

Purdue advisor: Michael Levine
UN advisor: Francisco Gomez

Nonparametric clustering of genomic data

Identification of coexpressed gene clusters in transcriptome data is a difficult task. There are two main types of algorithms for performing this clustering: distance-based or model-based. Distance-based algorithms typically use a metric between two pairs of data points and group them into similar groups. Model-based algorithms are based on the theory of mixed models, this theory helps the interpretability of the results obtained. A deficiency of mixed models is the difficulty they encounter in adjusting data to find an appropriate multivariate distribution according to the data that is handled. In this final degree project it is proposed to use non-parametric methods such as npEM and npMSL to solve this problem. In this way, the distribution of the biological sample is not specified and the grouping task is made easier. In our results with real data we show that our methods generate more biologically significant clusters than those proposed by algorithms based on parametric models.

Getting out of my comfort zone has been the norm during my research experience. Getting to know a different culture was by all means a great experience. I am saddened that this adventure came to an end. Nonetheless I am delighted with the things I could bring home: the relationships, the knowledge and the wisdom. I will look back to this moment as the one where being out of my home I felt more connected to the world. For a moment I believed the world was within reach.

Chem.Eng. Leslie Vanessa Sánchez Castillo
Master - Chemical Engineering

COLLEGE OF SCIENCE
Department of Biological Science

Purdue advisor: Dr. Rubén Claudio Aguilar
UN advisor: Dr. Rubén Darío Godoy Silva

Cellular Trafficking and its importance in basic cell biology

Currently, I am Master student at Universidad Nacional de Colombia, which is my *alma mater*. I had always had desire of coming to Purdue, and UREP-C in its first graduate edition program, made the dream come true. It has been a such rewarding and exciting experience, which surrounded me along an enthusiastic academic and international environment. Living in United States and doing research in one of the most prestigious institutions as Purdue University is, really has encouraged me to keep growing as a researcher and a world citizen.

As a Chemical Engineer, I have focused my research path on biomedical applications. The non-viral gene modification in animal cells is a subject that has captivated and made me fond since the beginning. This, bring me here to The Aguilar's Lab, where during my stay I participated in several projects for getting a deeper understanding in cellular trafficking and endocytosis mechanism. The whole work within the Aguilar's Lab have led in a better understanding of some neurodegenerative diseases, bladder cancer and even Covid—19 preliminary treatment study. In particular, the study in basic biology of some proteins like ACEII, EpsinR and Ack1 were the main focus in the projects I was involved with. At the same time, I mastered several biological techniques like mutagenesis, cellular imaging, viability and immunochemical assays. Hence, my research experiences in Dr. Aguilar's Lab strengthened my theoretical and experimental knowledge, giving me additional tools for my integral development as a researcher.

In summary, this internship has given me the opportunity of challenging myself, learning in more detail about basic biology, improve my research skills, and made me to enjoy a fantastic international experience with phenomenal people here at Purdue. GO BOILER MAKERS, GO!

Lina Margarita Rico Arevalo
Geological Engineering

COLLEGE OF SCIENCE
Department of Physics and Astronomy

Purdue advisor: Dr. Laura Pyrak
UN advisor: Dr. Gaspar Monsalve Mejia

Geophysics of Fractures using 3D printing

I am an undergraduate student at Universidad Nacional de Colombia. I am interested in the study of the structure and geology of the subsurface of the earth using geophysics methods. Currently, I am researching in the Department of Physics and Astronomy at Purdue University, using 3D printing to generate fracture networks and experimental components to analyze different topologies of fracture networks and apertures through acoustic emission and pressure-flow measurements, with the objective of understanding the use of physical methods to analyze rock fractures, which are essential for reservoirs of hydrocarbons, groundwater, or geothermal energy.

The thing I love most about my research experience is all the experimental tests I conduct by applying the knowledge that I've learned in my field of study.In doing so, I am able to challenge myself day by day.

Furthermore, being at Purdue has been one of the happiest, unforgettable moments of my life; amazing people, cultures, and places have made this experience unique.

Thanks Dr. Pyrak Nolte, Dr. Gaspar Monsalve, Felipe Rincon, family, Niñas Purdue, and friends.

Valentina Castañeda Amaya
Civil Engineering

COLLEGE OF SCIENCE
Department of Earth, Atmospheric and Planetary Sciences

Purdue advisor: Dr. Lei Wang
UN advisor: Dr. Carlos David Hoyos

The role of a subseasonal planetary wave pattern on U.S heat waves

Over the coming century, the severity of extreme heat related to heat waves is expected to increase; therefore, there is a need to improve the understanding of the dynamics behind these events. While heat waves are local phenomena, planetary wave variability may play a key role in providing large-scale circulation patterns conducive to the occurrence and persistence of the events. Applying different data analysis techniques and linear Rossby wave dynamics through a hierarchy of observations and numerical models, I evidenced the concurrence of a zonal wavenumber five pattern and heat waves. A better understanding of the dynamics of planetary wave patterns can lead to better forecasting of heat events beyond the typical 10-days advance skill.

During this experience, I was part of the Weather and Climate Dynamics Laboratory (WCDL) in which I was able to develop my own project focused on extreme heat events. Also, I was able to learn about the physics of climate, geofluid dynamics as well as the basics of general circulation numerical models. I leave with a growing curiosity and desire to continue my academic path looking forward to contribute to the field of atmospheric sciences.

Cristian Andres Salinas Castillo
Biology

COLLEGE OF AGRICULTURE
Department of Horticulture and Landscape Architecture

Purdue advisor: Dr. Lori Hoagland
UN advisor: Dr. Alejandro Caro-Quintero

The role of seed transmitted endophytes in the quinoa tolerance to cadmium stress

Quinoa is a promising crop for food security, due to its high nutritional content and adaptation to climate change. Most of the world yield comes from Peru and Bolivia and is exported to the US to produce manufactured food supplements. However, some regions in Peru are polluted with cadmium and quinoa grains absorb toxic quantities.

The main objective of this project is to identify how cadmium changes the bacteria and fungi found inside the quinoa grains and if those microorganisms could have beneficial activities to decrease cadmium concentration in quinoa and final consumers' uptake. During my research stay within the UREP-C Program, I contributed to this project in Dr. Lori Hoagland 's Soil Microbial Ecology Lab.

Firstly, molecular tests were set to identify the microbial seed diversity. Some of those microbes were isolated in vitro to assess biochemical activities which are beneficial to plant growth and decrease cadmium concentration in grains. Some of those microbes can be tested in quinoa plants to assess a new approach to decrease cadmium pollution and have healthier quinoa crops.

This experience shaped my career and changed my life. It showed me a world full of opportunities to make come true my dream of connecting international research with local challenges related with agriculture and food security. The best six months of my life.

Claudia Marcela Becerra Rativa
Environmental Engineering

COLLEGE OF AGRICULTURE
Department of Agricultural and Biological Engineering

Purdue advisor: Dr. Ankita Raturi
UN advisor: Dr. Juan Carlos Loaiza Usuga

Design for Agricultural Soil Health Information - DASHI

I'm an undergraduate Environmental Engineering student from Universidad Nacional de Colombia, Medellín, Colombia. I'm a research assistant under the guidance of Dr. Ankita Raturi, and my current work centers around soil health data management in agriculture. During my time in Colombia I've come to value the importance of working with communities (mainly 'campesinos') maintaining knowledge exchange, and my participation in the Agricultural Informatics Lab allows me to learn more about farmers in the USA, providing a more broad perspective about doing research with communities.

Current project I'm working on is DASHI, which is a qualitative study, under the field of human centered design. The long-term goal of DASHI project is to build better tech tools for farmers across the U.S. I participated in the first phases of the project, writing the study design and literature review.

Juliana Miranda Rodriguez
Agronomic Engineering

COLLEGE OF AGRICULTURE
Department of Agronomy

Purdue advisor: Dr. Cankui Zhang
UN advisor: Dr. Esperanza Torres

Elucidating the roles of plant vascular tissues in the long distance signalling under phosphorus stress condition.

My work was part of a project of the Plant Physiology Lab of Dr. Zhang, focused on the understanding the systemic nutrient acquisition responses in plants. This means, for instance, when plants uptake nitrogen (N) from the soil, this is often distributed heterogeneously in natural soil. Plants, therefore, have a systemic long-distance signalling mechanism by which N starvation on one side of the root leads to a compensatory N uptake on the other N-rich side. The hypothesis during my research was to prove if this mechanism work under phosphorus (Pi) starvation too.

Working with molecular techniques of genetic transformation, as well as assessing the gene overexpression under hydroponic conditions. We have seen that phloem-specific polypeptides that are induced in leaves upon perception of root-derived molecule act as descending long-distance mobile signals translocated to the root, triggering the upregulate expression of the Pi transporters genes in roots. This knowledge provides a strong background to the improvement in the breeding process of crop plants.

During my time here I had the chance to work with techniques that I only saw in a theoretical way before, and helped my to earn experience in this area of knowledge that I love so much, working with recognized professionals in a multicultural environment.

Juan Camilo García Peña
Agronomy

COLLEGE OF AGRICULTURE
Department of Botany and Plant Pathology

Purdue advisor: Dr. Christian D. Cruz
UN advisor: Dr. Joaquín G. Ramírez Gil

Application of modern epidemiology tools for wheat blast spatio-temporal dynamics modeling

During my stay at Purdue I had the opportunity to be part of the Cruz lab, a workgroup dedicated to '*study and develop strategies to manage high consequence plant diseases*'. As a team member I was able to engage in a project to characterize the epidemiology of wheat blast, a devastating but poorly understood disease that affects crop yields in wheat production areas in South America, South Asia and Southwest Africa. Being the wheat a major staple food in the world, and one of the major source of carbohydrates and vegetal protein for humans and animals, the disease poses a threat to worldwide food security.

My main task in this project was to describe the vertical movement of the disease in the plant canopy by using advanced statistical and mathematical approaches rarely implemented before in phytopathology. These methodologies were applied on visual disease severity data collected in a plant disease phenotyping system established in Bolivia by the workgroup; and will serve as the basis for future epidemiological analyses on other diseases.

Although a huge leap was made by incorporating novel techniques, there is still work to be done for developing further management strategies against wheat blast. The project was challenging, but showed me the importance of transdisciplinarity when we are addressing real world problems.

Isabella Cerchiaro Sanchez
Mining and Metallurgical Engineering

COLLEGE OF AGRICULTURE
Department of Forestry and Natural Resources

Purdue advisor: Dr. Zhao Ma and Dr. Laura Zanotti.
UN advisor: Dr. Oscar Jaime Restrepo Baena.

Literature review: Sustainable Development Goals and Artisanal and Small-scale Mining (ASM) in Bajo Cauca, Antioquia.

As a future engineer in this last year of my undergraduate, I have been greatly interested in sustainability, understanding that mining is an important factor in the development and dynamics of the territory of a country, and I have also understood the importance of communities in this activity and the responsibility we have as professionals, which motivated me to ask myself specifically "What are the main factors that affect the sustainability of Artisanal and Small-scale Mining in Bajo Cauca?" and that is how I came to this research.

The research that I am currently developing, it is a literature review that allows me to learn how the relationship between Sustainability, Sustainable Development Goals, and ASM type of mining has been interpreted by researchers, guided by the mentoring of my two advisors I have acquired the right tools to develop a successful literature review and I have also learned about how to conduct research when social aspects are involved.

Finally, thanks Universidad Nacional de Colombia and Purdue University for this opportunity, to Dr. Oscar Restrepo Baena, Dr. Zhao Ma and Dr. Laura Zanotti for allowing me to participate in their research groups and share their knowledge, and to all my friends who made this experience of much academic and personal growth, but above all, UNFORGETTABLE!

Adrianna Lucía Fragozo Alvernia
Civil Engineering

COLLEGE OF ENGINEERING
*Lyles School of Civil Engineering*

Purdue advisor: Dr. Kostantina 'Nadia' Gkritza.
UN advisor: Msc. William Castro García.

Impact of COVID-19 in travel behavior and mode choice: A perceptions and attitudes perspective.

COVID-19 generated a strong disruption in the way people travel and the need for mobility. Concepts such as working from home and online shopping became more practiced and accepted, and new modes were explored. Despite global efforts to mitigate the effects of COVID-19, there is no certainty about how long those effects will last in the future.

The project developed with the STSRG Sustainable Transportation Systems Research Group consists of understanding people's perceptions and attitudes towards shared mobility and emerging technologies in the post-pandemic era. This helps to forecast the long-lasting impacts of COVID19 on modal choice and travel behavior, as well as to understand what leads people to have certain preferences. In addition, this project serves to make the right decisions in transport planning in order to have environmentally, socially, and economically sustainable transport systems.

The project is in its first stage and my support consisted of a literature review for the preparation of a survey in conjunction with the research team. This experience was a valuable growth in my life, not only tackling research but also allowing me to learn from diversity and the international environment.
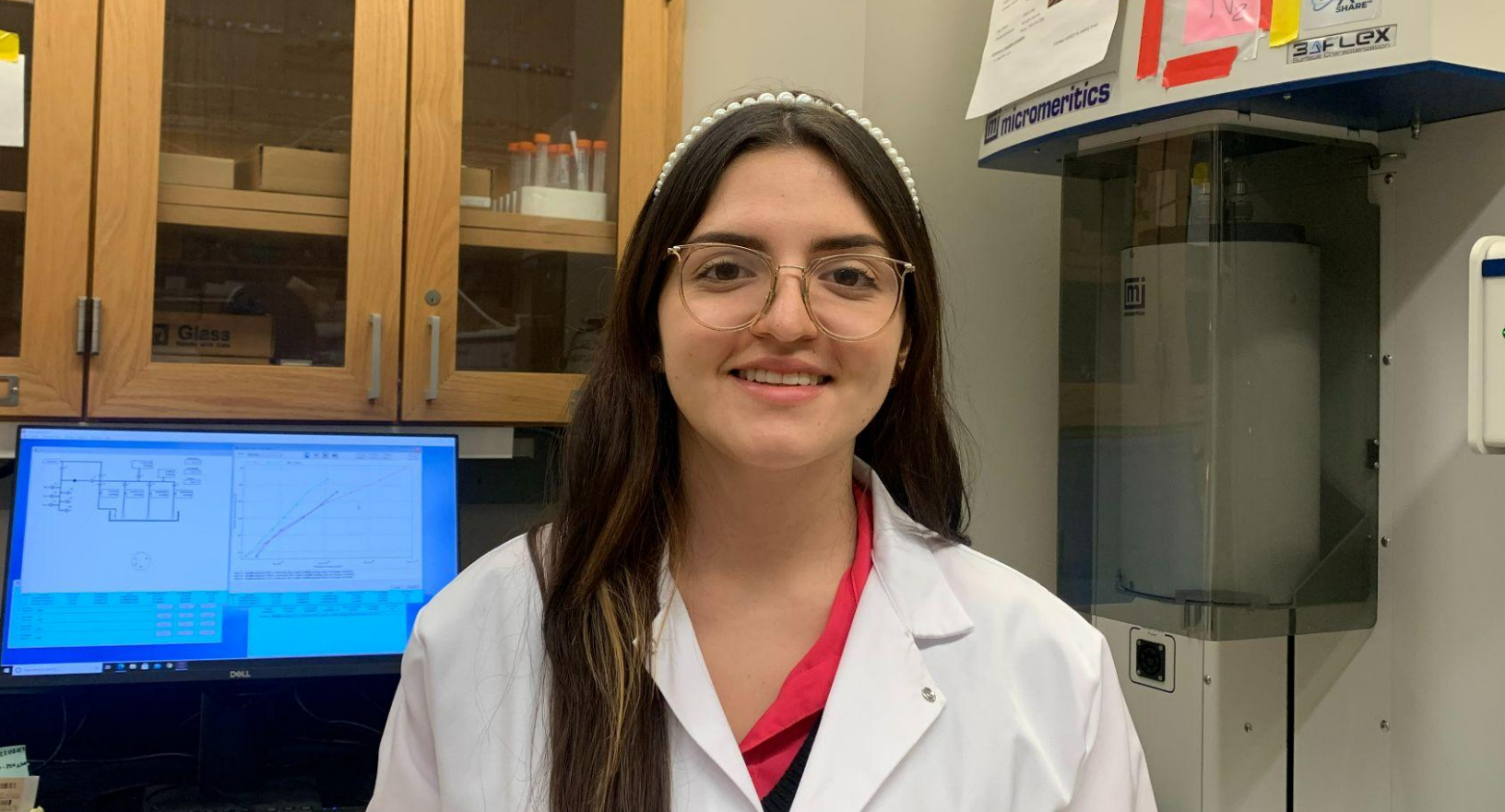
Angie Melisa Ocampo Giraldo
Chemical Engineering

COLLEGE OF ENGINEERING
Department of Chemical Engineering

Purdue advisor: Dr. Raj Gounder
UN advisor: Dr. Farid B. Cortés

H_2 Reduction of Distinct Types of Cu-CHA species in Presence and Absence of Water during the Aftertreatment of Diesel Engines

NO_x (nitrogen oxides) are produced in the majority by the transportation industry, and these greenhouse gases affect not only the environment but also human health. For this reason, they have to be treated to reduce their impact. The diesel aftertreatment engine is well known in this area to treat some of the pollutants produced by diesel engines, it has a diesel oxidation catalyst (DOC), which is designed to convert CO and hydrocarbons into CO_2 and water, a diesel particulate filter (DPF), which is designed to remove diesel particulate matter or soot, and lastly the selective catalytic reduction (SCR) that reduces NO_x with NH_3 and oxygen to form N_2 and water.

The work I have done in the Gounder's Group is to synthesized, characterized, and compared different arrangements of the chabazite zeolite modified with Cu atoms (Cu-CHA) used in the SCR. Because during the operation of the aftertreatment diesel engine the chabazite is exposed to hydrothermal aging which could damage its structure. Therefore, we are interested in evaluating how this zeolite behaves under dry and wet conditions, we use the hydrogen temperature reduction comparing between the temperature profiles of the different Cu-CHA (Z_2Cu, ZCuOH, mixed).

Carlos Alberto Torres Cañizares
Chemical Engineering

COLLEGE OF ENGINEERING
Department of Agricultural and Biological Engineering

Purdue advisor: Dr. Michael R. Ladisch
UN advisor: Dr. Mario Enrique Velásquez Lozano

Liquefaction and enzymatic hydrolysis of lignocellulosic biomass at high concentrations for biofuel purposes

The high consumption of traditional energy resources has led to looking for new alternatives to assure energy security in the long term. Therefore, there is currently an interest in biomass such as corn stover, sugarcane bagasse, wood, and others as raw materials for biorefineries.

During my internship, I worked at the Laboratory of Renewable Resources Engineering under the mentorship of Dr. Michael Ladisch and my GRA Diana Ramirez. In this experience, we carried out liquefaction and enzymatic treatment experiments of corn stover pellets to produce slurries with high content of reducing sugars and low values of viscosity. These two factors are relevant to maintain an economically feasible process. Nevertheless, there is a challenge, the physicochemical properties of biomass are not the same due to pre-harvest factors. For that reason, we evaluated various types of pellets to verify viable results to apply at the industrial level.

At the same time, I learned compositional analysis procedures of NREL, HPLC management, and design of experiments on bioreactors. This gave me a substantial background in the bioprocess field, but also soft skills to share my ideas with my lab team and meet people from different cultures. With this research stay, I have taken my *Next Giant Leap* in my professional and personal life because *we are the minds of today that will change and educate the minds of tomorrow.*

Carolina Bernal Botero
Chemical Engineering

COLLEGE OF ENGINEERING
Department of Mechanical Engineering

Purdue advisor: Dr. David M. Warsinger
UN advisor: Dr. Hernán D. Álvarez Z.

Multi-Staged Batch Counterflow Reverse Osmosis For High Recovery Desalination

Water is an increasingly scarce natural resource in the world. The demand for freshwater water is growing at a rate that can barely be met by its natural supply leading to acute shortages around the world. Reverse osmosis (RO) is a membrane separation process that can help mitigate this problem given its high thermodynamic efficiency and economic scalability. Batch counterflow reverse osmosis (BCFRO) is a recent RO configuration that uses saline streams on both sides of the membrane in counterflow and being a transient configuration allows the process to follow the osmotic pressure profile of the feed. This new configuration has multiple advantages, such as high recovery and final brine concentration which leads to less liquid discharges.

At Purdue I am part of the Warsinger Water Lab group and my role in this project has been focused on modeling, simulation, and optimization of some parameters such as fluxes and volumetric flow rates of the concentrate and the diluate circulation pumps to achieve higher final brine concentrations and make sure that the process can work in a cycle manner.

Civil Eng. Cristian Dario Garzón López
Master in Engineering - Structures

COLLEGE OF ENGINEERING
Lyles School of Civil Engineering

Purdue advisor: Dr. Pablo D. Zavattieri
UN advisor: Dr. Caori Patricia Takeuchi Tam

Evaluation of Durability of 3D-Printed Cementitious Materials for Potential Applications in Structures Exposed to Marine Environments

3D-Concrete Printing (3DCP) has been intensively explored for a variety of construction applications. The increasing interest in 3D-printed concrete structures designed for marine environments requires the development of concrete mixtures that can ensure adequate mechanical and durability characteristics of various components of such structures. The use of alternative materials and the control of printing parameters in 3D-printed concrete has emerged as an effective way of not only controlling the fresh properties and printability of mixtures, but also their mechanical and durability properties.

During my time at Purdue University, I had the opportunity to join the research project carried out by the Ph.D. student Fabian Rodriguez, under the direction and advice of Ph.D. Pablo Zavattieri, Ph.D. Jan Olek, Ph.D. Jeffrey Youngblood, where I was able to contribute with the execution of different types of tests on samples taken from different elements, which were printed using the robotic arm located in Bowen Lab.

I am very grateful to the UREP-C program, the experience and memories created during this time have contributed enormously in my way of seeing the world, the possibility of sharing with people of different nationalities, languages, and cultures has allowed me to think about my participation in the contemporary society as a global citizen.

David O. Holguín Mejía
Civil Engineering

COLLEGE OF ENGINEERING
Lyles School of Civil Engineering

Purdue advisor: Dr. Kumares Sinha and Dr. Samuel Labi
UN advisor: Dr. Sonia Mangones

Adoption of Hyperloop in the United States: Design of a Stated Preference Choice Experiment

The Hyperloop becomes more and more a reality and ceases to be just a theory, it was formally mentioned in 2013 by Elon Musk in a white paper "Hyperloop Alpha", promising to transport goods and people through capsules that reach speeds of up to 760 miles per hour, traveling routes like San Francisco - Los Angeles in just 35 minutes; Being completely electric and automated, Hyperloop would represent the best alternative to the trans-national train and air travel, offering a sustainable way to meet the high demand that increases day by day. Different studies have been developed about its economic, commercial, and technical feasibility, but little has been researched about its acceptance and possible adoption by society.

At Purdue I was part of the Artificial Intelligence & Connected Autonomous Vehicles (AI&CAV) group, where my work focused on the literature review and design of a stated preference choice experiment that seeks to study the acceptance and adoption of Hyperloop in different routes as Los Angeles-San Francisco or Atlanta-Orlando, located in the United States of America. Likewise I worked in the driving simulator project carried out in the CCAT facilities at Nextrans in Purdue Research Park.

Ericson Brayan Mesa Orjuela
Electrical Engineering

COLLEGE OF ENGINEERING
School of Mechanical Engineering

Purdue advisor: Dr. Luciano Castillo
UN advisor: Dr. Camilo Andrés Cortés Guerrero

Real-time airborne virus detection with Photoacoustic Spectroscopy (PAS)

After two years of the Covid-19 pandemic, there's still a big opportunity to improve respiratory virus detection to prevent transmissions. Even though the vaccination programs have reduced the pressure over the healthcare systems, new variants of the virus have shown higher infection rates and new pandemics are to be expected in the future.

At Purdue University, I contributed to a project by Dr. Castillo and Dr. Dana Weinstein that aims to develop hyper-fast and reliable detection of viruses in airflow. How? With photoacoustic spectroscopy, by modulating a source of infrared radiation, we can control the expansion and contraction of a gas sample and then use very sensitive microphones to record the pressure waves (sound) generated. As every molecule reacts better to specific radiation frequencies, we can identify which ones are present in the sample, analyzing how well they respond.

I'm deeply thankful to my family and friends who supported and inspired me before and during my UREP-C experience. Thanks UNAL, Purdue University, Dr. Camilo Cortés, and Dr. Luciano Castillo for this unique opportunity. And to my roommates who made every day the best time of my life. I learned about new concepts, techniques, equipment, and even myself and met people and cultures all over the world. Finally, as the first PEAMA student in UREP-C, I would like to invite my partners to trust in themselves and look for these life-changing experiences.

Jorge Enrique Neira García
Master - Industrial Automation

COLLEGE OF ENGINEERING
### Department of Mechanical Engineering

Purdue advisor: Dr. Nina Mahmoudian
UN advisor: Dr. John Alexander Cortés Romero

Path planning and tracking for an Autonomous Underwater Glider

Missions with autonomous underwater gliders (AUG) are valuable for applications, including oceanography, aquatic pipeline monitoring, and research of biological ecosystems. These vehicles stand out with advantages in energy efficiency, costs, dimensions, and stealthy operation. However, this technology does not use propulsion propellers, and, as a result, its autonomous control is a complex challenge with remarkable research potential.

ROUGHIE (Research-Oriented Underwater Glider for Hands-On Investigative Engineering) is a project that aims to improve the AUG's maneuverability and autonomous abilities with novel vehicle designs and control systems. I was part of its research team at Dr. Mahmoudian's Laboratory, and I participated in the experimental tests for the heading control subsystem and the development of the path planning and tracking strategies.

This research experience provided me with way more than academic development. The cultural exchange was enormous and enriching. I met fantastic people, and I shared incredible moments with them. In general, it significantly contributed to my personal growth. I am thankful to the UREP-C program, Purdue University, and Universidad Nacional de Colombia for this invaluable opportunity.
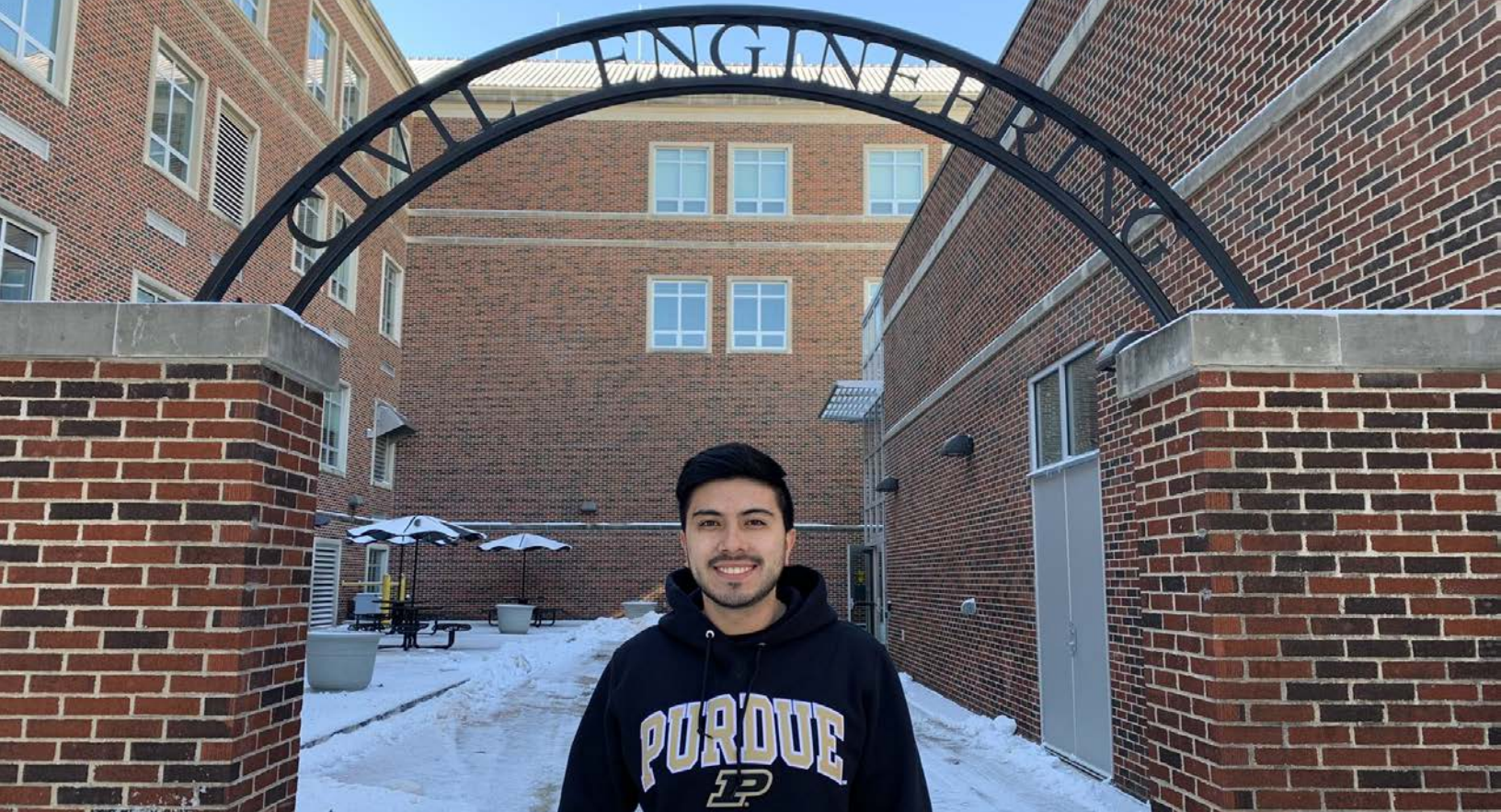
Juan Esteban Jiménez Piraján
Civil Engineering

COLLEGE OF ENGINEERING
Lyles School of Civil Engineering

Purdue advisor: Dr. Rodrigo Salgado
UN advisor: Dr. Mauricio Tapias

Influence of relative density and particle morphology on the bearing capacity of sands

During the six months of the UREP-C program, I have worked in the area of geotechnical engineering in the research group named "Center for Offshore, Foundation & Energy Engineering (COFFEE)" under the supervision of Dr. Rodrigo Salgado and Dr. Monica Prezzi.

The main part of the work consisted in supporting the Ph.D. student Rameez Ali Raja in the calibration chamber located at Bowen Laboratory, where some tests on a strip footing in sand are performed. Variations on the morphology and relative density of the sand by using two types of sand and different pluviators were done, in order to obtain the load-settlement curve and use the Digital Image Correlation technique (DIC) to study the behavior and bearing capacity of the sands. In addition, I have taken part in other two projects. The first related to the monitoring of loads and moments of an open-ended pipe pile of the instrumented Sagamore Parkway Bridge located in West Lafayette, IN, and the other concerning the installation of the instrumentation of a Mechanically Stabilized Earth (MSE) retaining wall in Whitestown, IN.

I had the opportunity of been enrolled in two subjects of the civil engineering undergraduate program (Geotechnical engineering I and II). This allowed me to complement my previous knowledge and learn about the design of geotechnical structures in the US.

Juan Sebastian Nocua Meneses
Mechanical Engineering - Industrial Engineering

COLLEGE OF ENGINEERING
Department of Engineering Education

Purdue advisor: Dr. Kerrie Douglas

A Learning Analytics Tool to Address Formative Assessment of Students Use of LMS Content: Sentiment Analysis for Discussion Boards

The incremental use of technological tools in educational contexts has led to the generation of large quantities of data. The existence of these new sources of data calls for the use of tools to analyze, visualize and interact with the data to generate insight and decision-making. One example is discussion forums, which thousands of student use and often contain relevant information about their perceptions or emotions about the courses. However, extracting perceptions from text strings is an onerous task.

Under the guide of Dr. Douglas from Engineering Education, Prof. Brinton from Electrical and Computer Engineering, and the Ph.D student Laura Cruz, we tackled this problem using Sentiment Analysis, from the Natural Language Processing computer science branch. A Learning Analytics Dashboard was designed to integrate validated results from this task.

This internship has opened my perspective profoundly, from the research work to the experience of living in the United States. I am very grateful to Purdue University and the Universidad de los Andes for giving me this opportunity, and to the members of the Universidad Nacional de Colombia for accepting me and integrating me as a member of UREP-C.

Karen Dayana Zabala Gomez
Chemical Engineering

COLLEGE OF ENGINEERING
School of Engineering Technology

Purdue advisor: Dr. Gozdem Kilaz
UN advisor: Dr. Gerardo Rodriguez

Jet and diesel fuels viscosity prediction using comprehensive two-dimensional gas chromatography (GC x GC-FID)

One of the most important and challenging concerns for the rapid prediction of various properties of aviation fuels is the quantitative relationship of property composition due to these fuels consist of hundreds of various hydrocarbons. To allow an alternative or traditional fuel to be used successful, it is necessary that they comply with the provisions of the ASTM D7566 (jet fuel) and ASTM D975 (diesel fuel) standards, which indicate the maximum viscosity that is allowed in fuels at certain temperatures.

In this project, it has been possible to obtain detailed chemical compositions of both conventional and alternative jet and diesel fuels using two-dimensional gas chromatography with a flame ionization detector [GC x GC-FID]. Additionally, through a SVM 3001 Stabinger viscometer, it was possible to know the kinematic viscosity of the fuels at temperatures of -20 °C and 40 °C for jet and diesel fuel, respectively. With the data of experimental viscosity and chemical composition, using the ordinary least squares (OLS) regression method, it was possible to obtain a linear regression that predicts the viscosity of fuels from the mass composition of its main components.

I am grateful because this experience opened my mind. I had to over-came my limits doing things that I did not believe I was able to do. Now, I am proud of my abilities and remember every day I spend in Purdue as the most amazing days I have had so far.

Laura María Núñez Álvarez
Mechanical Engineering

COLLEGE OF ENGINEERING
Department of Mechanical Engineering

Purdue advisor: Dr. Adrian Buganza Tepole
UN advisor: Dr. Juan Fernando Ramirez Patino

Mechanical characterization of radiated skin and implications to tissue expansion for breast reconstruction surgery

Tissue expansion is a technique utilized to induce skin growth prior to breast reconstruction surgery that follows mastectomy. The radiotherapy procedure on oncological patients causes dermal injury due to collagen architecture disruption and may lead to complications in the expansion process. Here, we analyze radiation-induced changes in skin expansion and mechanical properties in porcine skin.

My responsibilities in this project included digital image correlation analysis of biaxial tests on skin samples and fitting the mechanical response to various constitutive models. I am pleased with the experience because it has sparked my problem-solving, coding, and writing skills.

I have had the chance to work for a real healthcare solution which showed me and remind me that science has an undeniable social impact. That is why I hope to continue my way into research.

Industrial Des. Leidy Carolina Fernández Peña
Master in Engineering - Transportation

COLLEGE OF ENGINEERING
Department of Industrial Engineering

Purdue advisor: Dr. Hua Cai
UN advisor: Dr. César Augusto Ruíz Rojas

Quantifying the GHG emissions of Bike Sharing Systems in U.S.

The Urban Sustainability Modeling & Analysis Research Team (uSMART) uses agent-based modeling, life cycle assessments, system dynamics, big data analytics, GIS, and optimization tools to study the environmental implications of emerging technologies from the systems perspective. Therefore emerging transportation systems as Bike Share Systems are a field of interest.

Although bike sharing is viewed as a sustainable transportation mode, it still has environmental footprints from its operation and upstream impacts. Thus, examining the environmental impacts of BSS from the life cycle perspective is vital to inform decision making for the system design and operation, in this case, quantifying the greenhouse gas emissions.

My work as researcher has consisted in developing a tool to quantify GHG emissions processing the information available for several bike share systems around U.S. to accomplish this task I have to elaborated a tool that iterates the process for all the cities, taking into account issues, alternatives and city particularities using data analytics and applying my transportation knowledge.

This experience gave me the opportunity to learn and develop skills that I can apply in my master's thesis and enhance my professional profile.

Paubla Andrea Gallego López
Mining and Metallurgical Engineering

COLLEGE OF ENGINEERING
Department of Chemical Engineering

Purdue advisor: Dr. Raj Gounder
UN advisor: Dr. Oscar Jaime Restrepo Baena

Effects of synthesis procedure on Pt Particle Size in Pt/γ-Al$_2$O$_3$ Catalysts for Ammonia Slip Applications

Diesel engine exhaust provides greenhouse gases, and particulate matter to the environment; it is considered as one of the largest contributors to environmental pollution. Consequently, a catalytic exhaust aftertreatment system is necessary to convert the gas exhaust from diesel engines into CO_2, H_2O, and N_2.

Ammonia Slip Catalyst (ASC) is the fourth stage of the system; it converts NH_3 into H_2O, and N_2 before it reaches the environment. My project is focused on developing synthetic strategies to influence Pt particle sizes on Al_2O_3 supports; Pt/γAl$_2$O$_3$ is the catalyst used for the NH_3 oxidation in ASC. The motivation to research in this topic is the oxidation state of the Pt since metallic Pt has shown a higher rate for NH_3 oxidation than oxidized platinum. In addition, the oxidation state of the Pt is directly related with Pt particle size.

At Purdue I am part of the Gounder research group that is focused on catalysis, kinetics and mechanisms, and automotive pollution abatement. Thanks Universidad Nacional de Colombia, Purdue University, Dr. Raj Gounder, Dr. Oscar Jaime Restrepo Baena, and Brandon Kyle Bolton for giving me the opportunity to start my path as a future researcher.

Paula Andrea Torres Loza
Medicine

COLLEGE OF ENGINEERING
Department of Biomedical engineering

Purdue advisor: Dr. Craig Goergen
UN advisor: Dr. Juan Carlos Bustos

The effects of renal vein stenosis during murine pregnancy

Preeclampsia and other hypertensive disorders of pregnancy impact 2-8% of pregnancies with often devastating results. Preeclampsia is broadly considered to be a placental disorder and understanding of the pathogenesis focuses on angiogenic and anti-angiogenic factors released by this maternal/fetal organ. This explains many early-term cases of preeclampsia, but fails to adequately address cases further on in gestation where abnormal changes in these biomarkers are not always seen. Under the guide of Dr. Craig and Prof. Bustos and the Ph.D student Jennifer Anderson we study this project collecting B-Mode, EKV data, color doppler images, and PW doppler ultrasound images, using tail cuffs to obtain murine blood pressure, and performing data and statistical analysis.

As a medical student having the opportunity to work in an engineering laboratory taught me the importance of working with an interdisciplinary team and has opened my perspective about different ways of practicing medicine and how to join my clinical experience with research.

This internship is an amazing opportunity to every student and I am honored to be part of the UREP-C program. Thank you so much Purdue University, CVIRL Laboratory and the Universidad Nacional de Colombia for giving me this opportunity.

Natalia Gómez Amaya
Geological Engineering

COLLEGE OF ENGINEERING
Department of Civil Engineering

Purdue advisor: Dr. Monica Prezzi
UN advisor: Dr. Jorge Ivan Tobón

Sandy soil behaviour under cyclic loading- liquefaction in Ottawa 20/30 silica sand.

During my research experience at Purdue I had the opportunity to work in COFFEE (Center for Offshore, Foundation, & Energy Engineering) in the analysis of sandy soil under cyclic loads.

Understanding the liquefaction phenomena produced by the strong shaking during an earthquake is important in geotechnics given the effects that may occur after this state is reached (e.g., ground settlement or flow failure) and the potential damage to infrastructure. This event occurs when the structure of deposits made up of saturated sand begins to lose its strength in response to rapidly dynamic loading. To study the liquefaction in the laboratory we worked on Dynamic Hollow Cylinder, this device has the ability to simulate the conditions during an earthquake. For the test we considered variables such as: the relative density of the sands, the initial effective stress of the sample, the magnitude of the cyclic load to be applied and the frequency with which this load is applied.

I was responsible to prepare the samples, and I learned how to operate this unique device. Additionally, I was part of the project that monitored the loads and the changes on the open pipe-pile at the instrumented Sagamore Bridge. And I helped with the characterization tests on soils from the MSE retaining wall in Whitestown, IN.