WELCOMES YOU

TO THE SEVENTH ANNUAL

UNDERGRADUATE RESEARCH

AND CREATIVE ACTIVITIES

EXPO 2020

Lamar University

September 25, 2020
Welcome to Lamar University’s 7th Annual Undergraduate Research and Creative Activities, EXPO 2020. The event is organized by the Office of Undergraduate Research with the goal of inspiring undergraduate students from all majors to explore their field of interest and engage in research and/or creative activity.

The interest of Lamar undergraduate students and faculty in research and creative activities has increased each year, since 2013 when the first OUR sponsored conference was organized at Lamar, which is reflected by an increase in the number of OUR grants, SURF fellowships, and travel support to conferences and workshops.

The sponsorship and development of research projects during the COVID-19 pandemics by Lamar students and faculty demonstrates that our academic community has a strong commitment to student success. In these difficult times the OUR spirit strengthens, and the proof is our presence here today. With such attitude Lamar is becoming more and more an example for many regional and national 4-year colleges to follow in our footsteps. The EXPO event is an opportunity for our students to present the results of several months of hard work. Make the most of this experience and thank you for your involvement.

Dr. Kenneth Evans
President
Lamar University

It is my pleasure to heartily welcome you to Lamar University’s 7th Annual Undergraduate Research EXPO 2020 organized by the Office of Undergraduate Research! EXPO is now a well-established event, where undergraduate students from all disciplines and majors at Lamar can present their research findings. This year the event has 21 research presentations, with fourteen presentations in the STEM area and seven from HASBSEB, distributed in five breakout sessions.

The EXPO event proves again that the Office of Undergraduate Research has become a robust platform for promoting student research at Lamar University. The Office of Undergraduate Research also provides undergraduates research grants which are conducted during the regular semesters, SURF fellowships for summer, and support for student travel.

I invite everyone to enjoy the presentations which reflects the intellectual curiosity of our students, and the mentorship for our faculty, especially in this time of global crisis. The EXPO today proves our human endurance and resiliency to the COVID-19 pandemics and illustrates our students’ desire and commitment to excel in their academic preparation for a successful personal and professional life. Kudos to both students and faculty for their efforts and results reported today. Enjoy the conference!

Dr. Brenda Nichols
Provost and VPAA
Lamar University
Dear Students, Colleagues, and Guests,

I welcome everyone to the Seventh Annual Undergraduate Research and Creativity, EXPO 2020. Twenty-two undergraduates will present 21 projects from various areas of research and creative activities ranging from biology, business, chemistry, music, engineering, physics, psychology, sociology, kinesiology, speech and hearing sciences. These presentations will cover scholarly accomplishments done at Lamar during the spring semester of year 2020. The video presentations will show the enthusiasm characteristic to their apprentice role in research and creative activities, as well as the efforts they put for becoming good professionals in their field of interest. These presentations will show the potential Lamar has now in offering research facilities and adequate support to run undergraduate research projects, which are competitive at national and international level. The invitation Mr. Daniel Quispe received to present his O.U.R. research project on solar cells efficiency at the prestigious and highly competitive Posters on the Hill event in Washington DC, in April 2020, is a strong evidence of Lamar’s competitiveness in undergraduate research. Posters on the Hill is the premier annual event organized by the Council of Undergraduate Research.

The EXPO 2020 will also include a panel discussion with four Lamar alumni who are now in graduate programs at Lamar University [Caitlyn Clark (Chemistry) and Anna Sigur (Speech and Hearing)], Rice University [Tyler Nelson (Applied Sciences)], and Indiana State University [Julio Benjamin Morales (Kinesiology)] for revealing the importance of undergraduate research in their academic readiness for pursuing studies at the graduate level.

Dear Students, today we celebrate your scholarly accomplishments. I would like to thank all of you, students and faculty mentors for putting generously your time and effort in research and creative activities despite the current situation with the COVID-19 outbreak, and all the challenges and frustrations that came along with it.

I want to thank heartily President Kenneth Evans and Provost Brenda Nichols for their continuous and generous support to the Office of Undergraduate Research for pursuing our mission. My special thanks go also to all academic Deans and Chairs for their encouragement to faculty and students to follow the pathway of research and creativity.

Cristian Bahrim, Acting Director of O.U.R.

Thank you to ALL the OUR Advisory Board members for their essential contribution to the success of the O.U.R. programs.

Dr. Kendrick Aung
College of Engineering

Dr. Tracy Benson
College of Engineering

Dr. Kelley Bradley
College of Engineering

Dr. Eileen Curl
College of Arts and Sciences

Dr. Bianca Easterly
College of Arts and Sciences

Dr. Gevorg Sargsyan
College of Business

Dr. Monica Harn
College of Fine Arts & Communication

Dr. Matthew P. Hoch
College of Arts and Sciences

Dr. Xiangyang (Sunny) Lei
College of Arts and Sciences

Dr. Nicki Michalski
College of Fine Arts & Communication

Dr. Mamta Singh
College of Education and Human Development

Dr. Dorothy Sisk
College of Education and Human Development

Dr. Robert Worley
College of Arts and Sciences

Dr. Juan Zabala
University Advancement

CONTACT US: CHEMISTRY BUILDING, ROOM 115A/B
P: 409-880-8290 Email: cristian.bahrim@lamar.edu
1:30 pm Welcoming Remarks from
President Kenneth Evans and Provost Brenda Nichols

1:40 pm Special Guest – Dr. Seiichi Matsuda, Dean of Graduate and Postdoctoral Studies at Rice University, E. Dell Butcher Professor of Chemistry

Panel Discussion 1:45 – 2:00 pm

The Impact of Undergraduate Research in Pursuing Graduate Studies.

Panelists:
Cailtyn Clark – Lamar University – Graduate Program in Chemistry
Julio Ben Morales – Indiana State University – Graduate Program in Kinesiology
Tyler Nelson – Rice University – Graduate Program in Applied Sciences
Anna Sigur – Lamar University – Graduate Program in Speech and Hearing

2020 Faculty Mentor Award – Dr. Ian Lian – Professor of Biology 2:00 – 2:10 pm

Dr. Ian Lian
Associate Professor of Biology

Dr. Ian Lian received his PhD degree in Biomedical Engineering from University of California at San Diego and joined Lamar University in 2013. Through his research lab in the Department of Biology, Dr. Lian has published 15 peer-reviewed papers on some of the top scientific journals, including Nature, and accumulated over 1,600 citations since 2015. He has mentored many outstanding undergraduate students, including McNair Scholars, Beck Fellows, Goldwater Honor Roll recipient, Reaud Honors College Summer Research Fellow, National Institute of Standards and Technology (NIST) fellow, and Office of Undergraduate Research (OUR) scholarship recipients. Notably, a team of research students from Dr. Lian’s lab has won the Poster on the Hill honor as the only awardees selected by Council on Undergraduate Research (CUR) from the State of Texas in 2015. Through active collaborations, Dr. Lian was able to send his students to Rice University (UCSD), as well as Academia Sinica in Taiwan for extended summer research. Dr. Lian works with students to amplify their diverse backgrounds and strengths, and more than 50 of his students have been accepted into professional schools and highly ranked PhD programs within the past 5 years.

Congratulations!
Panel discussion with Lamar alumni, who are now in graduate programs

“THE IMPACT OF UNDERGRADUATE RESEARCH IN PURSUING GRADUATE STUDIES”

Panelists:

- Caitlyn Clark – Lamar University – Graduate Program in Chemistry
- Julio Ben Morales – Indiana State University – Graduate Program in Kinesiology
- Tyler Nelson – Rice University – Graduate Program in Applied Sciences
- Anna Sigur – Lamar University – Graduate Program in Speech and Hearing

Excerpts about our panelists:

Ms. Caitlyn Clark has just completed her BS in Chemistry, this past summer, and now continues her MS studies in Chemistry at Lamar, under Dr. Ozge Gunaydin-Sen's supervision. Most of her research done at Lamar was with Dr. Sen and in close collaboration with Emily Ingram. Together they received an award for an oral presentation at the 7th Texas STEM conference in fall 2019, and an OUR grant for year 2019-20. Caitlyn was also a SURF winner in summer 2019, a STAIRSTEP grant recipient in summer 2018, and a presenter for ACS Orlando National poster competition in Spring 2019.

Mr. Julio Ben Morales is a Lamar Alumnus with a BS in Kinesiology from Lamar. Ben was a SURF and OUR grant recipient. He was accepted to present at the American College of Sports Medicine (ACSM) Annual Conference in San Francisco, California May 26-30, 2020, the paper “Relationship of Blood Lactate and Sweat Lactate to Exercise Intensity”. The ACSM Annual Meeting has built a reputation as one of the profession’s premier events. Now, he is at Indiana State University, as a graduate teaching assistant in the Biomechanics lab of the department of Kinesiology, Recreation, and Sport. He is working on his MS thesis in Exercise Science.

Mr. Tyler Nelson is a Lamar alumnus with BS degrees in Mechanical and Biology, and currently attending the Applied Physics PhD Program at Rice University. Before graduation from Lamar, Tyler has published along with his mentor Dr. Ian Lian in the Journal of Physical Chemistry Letters vol 11 (10), pages 4173–4178 (May 2020), an article titled “Dependence of Membrane Tether Strength on Substrate Rigidity Probed by Single-Cell Force Spectroscopy”, in collaboration with a Bioengineering group from Rice University. In addition, as a result of working with Dr. Lian’s clinical collaborators in Taiwan, Tyler has a second peer-reviewed article titled “Comparison of Findings between Clinical Examinations and Drug-Induced Sleep Endoscopy in Patients with Obstructive Sleep Apnea Syndrome” published in the International Journal for Research and Public Health, in the August 2020 issue.

Ms. Anna Sigur graduated with her BS in Speech and Hearing Sciences and is now working on her MS in Speech-Language Pathology at Lamar University. Over the summer, she worked as a graduate research assistant for Dr. Jamie Azios. She’s currently working with people with aphasia in the Aphasia Conversation Lab at Lamar as part of her graduate clinical work.
SESSION - STEM 1 2:10 – 2:47 pm

**Tyler Nelson** | Major in Mechanical Engineering |
Mentor: Dr. Ian Y. Lian
Project in Biology
Title: “Development of 3D Printed Substrate for β-islet Cell Culturing”
Presentation will begin at 2:10 pm

**Kyleigh Dixon** | Major in Civil Engineering |
Mentor: Dr. Thinesh Selvaratnam
Project in Civil Engineering
Title: “Development of an Algal-based Landfill Leachate Treatment System”
Presentation will begin at 2:16 pm

**Matthew Johnson** | Major in Electrical Engineering |
Mentor: Dr. Cengiz Sen
Project in Physics
Title: “Using Python Programming Software to Identify Radio Signals of Interest in Radio Pulsar Data”
Presentation will begin at 2:27 pm

**Donna Fleming** | Major in Chemistry & Biochemistry |
Mentor: Dr. Christopher B. Martin
Project in Chemistry
Title: “Synthesis of Epoxyketene Precursors”
Presentation will begin at 2:38 pm
Julio Benjamín Morales | Major in Health and Kinesiology | Mentor: Dr. Julio Morales
Project in Exercise Sciences
Title: “Reliability and Validity of New Test to Measure Anaerobic Power”
Presentation will begin at 2:50 pm

Anna Sigur | Major in Speech and Hearing Sciences | Mentor: Dr. Jamie H. Azios
Project in Speech and Hearing Science
Title: "Understanding Design Features of Aphasia-friendly Written Material: What Matters Most to People with Aphasia?"
Presentation will begin at 3:00 pm

David Martinez | Major in Sociology, Social Work, and Criminal Justice | Mentor: Dr. Terry Mena
Project in Social Work
Title: "How First-Generation Latinx Students Perceive a Higher Education"
Presentation will begin at 3:09 pm

Viviana Denova | Major in Business Management | Mentors: Dr. Gevorg Sargsyan and Dr. Kabir Sen
Project in Economics and Finances
Titles: "The Economic Impact of Tourism on the Texas Gulf Coast and Costa Blanca" and "Role of Small and Medium Enterprises on the Economy of the Alicante Province and the Southeast Texas"
Presentation will begin at 3:12 pm

Lauren Ocnaschek | Major in Health and Kinesiology | Mentors: Dr. Shannon Jordan and Dr. Alan Moore
Project in Exercise Sciences
Title: "Cardiovascular Exercise and Academic Performance at the Undergraduate Level"
Presentation will begin at 3:23 pm
SESSION – STEM 2  3:30 – 4:50 pm

**Caitlyn Clark and Emily Ingram** | Majors in Chemistry & Biochemistry and Chemical Engr. | Mentors: Dr. Ozge Gunaydin-Sen and Dr. Cengiz Sen

**Project in Chemistry and Physics**
**Title:** “*Investigations of Autocatalytic Phenomena using a Continuously Stirred Tank Reactor and Python Simulations*”
Presentation will begin at 3:30 pm

**David Halnon** | Major in Physics |
**Mentors:** Dr. Philip Cole and Dr. Jim Jordan

**Project in Physics**
**Title:** “*Quantitative Optical Gas Imaging – Remotely Quantifying Hydrocarbon Leaks*”
Presentation will begin at 3:43 pm

**Sindi Castillo** | Major in Biology |
**Mentor:** Dr. Ashwini Kucknoor

**Project in Biology**
**Title:** “*The Inflammatory Investigation of Cervical Cancer Cells in Response to Trichomonas Vaginalis*”
Presentation will begin at 3:50 pm

**Menna Elsaka** | Major in Chemistry |
**Mentor:** Dr. Ashwini Kucknoor

**Project in Biology**
**Title:** “*Effect of Akkermansia Muciniphila on Intestinal Epithelial Cell Integrity upon Interaction with Other Common Gut-Bacteria*”
Presentation will begin at 4:02 pm

**Dylan Palmer** | Major in Mechanical Engineering |
**Mentor:** Dr. Chun-Wei Yao

**Project in Mechanical Engineering**
**Title:** “*Fabrication of Superhydrophobic Aluminum Surfaces*”
Presentation will begin at 4:20 pm

**Daniel Quispe** | Major in Mechanical Engineering |
**Mentor:** Dr. Jian Cao from Northwestern University, Material Research Science Ctr.

**Project in Mechanical Engineering – Material Sciences**
**Title:** “*The Effects of Yarn Variations on Triaxial Braid Composites Fabrics.*”
Presentation will begin at 4:33 pm

SESSION – STEM 3

4:51 – 5:37 pm

Jordan Snowden | Major in Biology |
Mentor: Dr. Matthew P. Hoch
Project in Biology
Title: “Exploring Light Dependence of Sulfide Oxidizing Microbial Communities in Southeast Texas Coastal Marsh”
Presentation will begin at 4:51 pm

Rebekah Schilberg and Ablasse Kingcaid-Ouedraogo | Major in Chemistry & Biochemistry |
Mentor: Dr. Sylvestre Twagirayezu
Project in Chemistry
Title: “Accurate Methods Based on Molecular Rational Resonance Spectroscopy for Fast Detection of Polar Impurities in Petroleum Mixtures”
Presentation will begin at 5:07 pm

Kimanh Tsan | Major in Biology |
Mentor: Dr. Matthew P. Hoch
Project in Biology
Title: “Microbial Response to and Environmental Fate of Starch-Copper Oxide Nanoparticles in an Aquatic Ecosystems”
Presentation will begin at 5:19 pm

Samantha Marchner | Major in Biology / Pre-Med |
Mentor: Dr. Maryam Vasefi
Project in Biology
Title: “Associations Between Beta-Amyloid Aggregation and Pathogens in Alzheimer’s Disease”
Presentation will begin at 5:30 pm

SESSION – Hasbseb 2

5:37 – 6:00 pm

Colby Fore | Major in Music |
Mentor: Richard Condit
Project in Music
Title: “An Undergraduate Perspective on Jazz Education and Performance: Musical and Personal Development”
Presentation will begin at 5:37 pm
Muskaan Ali | Major in Psychology |
Mentors: Dr. Raymond Doe and Dr. Elizabeth Aronson

Project in Psychology
Title: "Does mindfulness awareness improve college students' task performance?"
Presentation will begin at 5:47 pm

Closing Remarks

Dr. Kumer Das – AVP for Research, Innovation and Economic Development, Assistant Provost at University of Louisiana at Lafayette, Professor of Mathematics

6:00 pm - Bringing EXPO to Lamar University – A New Tradition

Dr. Cristian Bahrim – Acting Director of O.U.R.
Awards for The Best STEM Presentation and The Best HASBSEB Presentation.
The selection was made by the Advisory Board Members of O.U.R.

Congratulations To All Presenters for a job well done!

Thank you all for the participation to Expo 2020

Plan to join us for the next Expo in April 2021
Development of 3D Printed Substrate for β-islet Cell Culturing

A projected 578 million people around the globe are expected to develop either type 1 or type 2 diabetes by the year 2030 (10.2% of world population). In the past decade, insulin prices have spiked and are expected to continue increasing. Many type 2 diabetics do not take insulin, and instead regulate blood sugar using diet and exercise or drugs such as metformin. However, since type 1 diabetics cannot make insulin endogenously, they cannot regulate blood sugar and must take artificial insulin. In the U.S. in 2016, the average type 1 diabetic spent about $5700 on insulin. Islet cell transplantation has been demonstrated to reverse disease, leading to endogenous insulin production in type 1 diabetes patients. However, this procedure requires more donor islet cells than can be obtained from a single pancreas, meaning patients must often wait for two donor pancreases to become available within a limited window of time. If these insulin-producing islet cells could be grown in vitro in very large numbers, the problem of finding donors could be solved. Insulin-secreting islet cells, or β-islet cells, are difficult to expand in vitro due to the lack of structural and chemical support provided by various supporting cells in vivo. β-islet cells grow in large clumps in vitro leading to an inability to oxygenate. Our proposed solution to this is to use 3D printed plastic substrates. This could allow the β-islet cells to grow more densely and vigorously.

We designed and printed a number of different 3D substrates out of PLA plastic with varying geometries and dimensions. Our 3D printer was unfortunately limited to a 0.2mm layer height with a 0.4mm extruder diameter, meaning we had to attempt to design the substrates around this limitation. Methods to print fine details despite this limitation will have to be researched. The substrates were designed to allow maximal nutrient flow through small channels as well as to allow as many β-islet cells to attach as possible. In order to quantify the effectiveness of these substrates, an assay known as an insulin ELISA must be performed to measure insulin production.
Development of an Algal-based Landfill Leachate Treatment System

This semester I was given an incredible opportunity to engage in an OUR sponsored research project. The activities I took part in were hands-on in lab experiences. By monitoring a mixture of landfill leachate and lab-grown algae, we could get a better perspective on if this process would function in the field. Preparing standard growth media, growing our algae, and taking measurements of different nutrient levels were a few of the main things we did this semester. We added this data into an excel sheet and observed the changes throughout the different concentrations. Our process was to grow the algae within the lab and then add different levels of diluted landfill leachate. The goal is, of course, to have minimal dilution, but that was not what our results provided. The most amount of dilution we used was the most effective, and it was extremely different from the others.

I would say my biggest challenge was keeping up with the extremely intelligent graduate student I was working with. It was a real privilege to get to work alongside someone with such knowledge and learn from him, but at times it could be difficult to keep up. The skills required for me in this research were basic skills I expect any good leader to have. As a recipient of OUR, I hold myself to a higher standard of other students at Lamar and consider myself to be an exceptional leader. Skills that I think make me a leader are my abilities to learn quickly, be organized, and strive to be better every day. These basic skills are what helped me accomplish everything in my research. Each activity was something I had never done before, so I had to keep these leadership skills in mind when facing new challenges. Our research group submitted a research paper that was accepted for publication.

This experience is something I truly take pride in being a part of. I am extremely thankful to the Lamar University Office of Undergraduate Research for making this opportunity possible and to my mentor Dr. Thinesh Selvaratnam for introducing me to the research possibilities. I am incredibly honored to be a SURF and OUR grant recipient because I have to pay for my own tuition and did not expect to have time to get the college experience I truly desired. Lamar University has shown me that this is possible, and Dr. Thinesh has made my research experience exceptional even with my busy and demanding schedule. I really cannot imagine going through college without the undergraduate research opportunity and experience that I have had.
Matthew Johnson  
**Mentors:** Dr. Cengiz Sen  
**Research in Physics**  
**Department of Physics**  

**Using Python Programming Software to Identify Radio Signals of Interest in Radio Pulsar Data**

Fast radio bursts (FRBs) are very energetic millisecond duration radio pulses originating from outside of our galaxy. To date there have been 90 FRBs discovered with ten of those being of a repeating nature, and only three of those being localized to host galaxies. The first FRB was discovered by analyzing past radio pulsar data. In this project, we analyzed the radio pulsar data in the region of the galaxy clusters as well as FRBs and plotted their locations in the visible space. In our analysis we used the Astropy software, which consists of a collection of Python codes, and contains various classes, utilities, and a packaging framework intended to provide commonly-used astronomy tools for professional and amateur astronomers alike.

Astropy, a software package that makes use of various Python source code, is the standard professional use software in the astronomy and astrophysics community. It excels in collecting data from the Astrophysics/Astronomy databases, which are based in NASA facilities or in Universities around the world. It allows one to query, download and manipulate that data, and also includes various visualization tools. In this project, we set out to learn how to properly use Astropy and how to use it to perform the operations that we had need for. The Astropy website (https://www.astropy.org/) is set up so that people unfamiliar with the software can complete tutorials on wide ranging subjects in the astrophysics community in order to be able to achieve the desired results with the software. The tutorial that we began with was a tutorial detailing how to read data into Astropy from a text file and then generate figures from that data.

In order to import the data to be used in our analysis, we first began by importing some of the data by using the code shown in Figure 1. This code allowed us to import the FRB and cluster data from the NED1 database by manipulating the argument in line two. The data then saved csv format, which is used by the Astropy software for further manipulation and visualization, as explained below.

![Figure 1. Python source code used to import FRB data from the NED database.](image)

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1 The NASA/IPAC Extragalactic Database (NED) is an information system provided to the astronomical community that facilitates and accelerates multi-wavelength research on objects beyond our Milky Way galaxy. It is designed, developed, maintained and operated at IPAC, under contract with NASA.
Before we could generate our figures, we studied various code examples in the tutorials on the Astropy website. As can be shown in the following code in Figure 2, we read in the data from a table in line 1. Then, in line 2, we filled in any not a number (nan) values so that the software could properly interpret the data. Then, to generate figures from the data, we input lines 3 through 6 to create the first figure in Figure 3, lines 7 through 14 generated the middle figure, and then the final figure was created from lines 7 through 14 with changing “mollweide” to “lambert”. The latter are various projections used to visualize data in the galactic plane.

```python
1 tbl = ascii.read("Young-Objects-Compilation.csv", header_start=1, data_start=2)
2 tbl[["RA",].filled(np.nan)
3 plt.scatter(data["Jmag"] - data["Kmag"], data["Jmag"])) # plot J-K vs. J
4 plt.ylim(reversed(plt.ylim())) # flip the y-axis
5 plt.xlabel("J-K", fontsize=20)
6 plt.ylabel("J", fontsize=20)
7 Ra = coord.Angle(data["RA"], filled(np.nan))
8 Ra = Ra.to("180":u.degree)
9 dec = coord.Angle(data["Dec"], filled(np.nan))
10 fig = plt.figure(figsize=(6,6))
11 ax = fig.add_subplot(111, projection="mollweide")
12 ax.scatter(ra.radian, dec.radian)
13 ax.set_xticklabels(["14h","16h","18h","20h","22h","0h","2h","4h","6h","8h","10h")
14 ax.grid(True)
```

Figure 2. Python source code used to manipulate and visualize FRB and cluster data.

![Figure 2](image.png)

Figure 3. Results generated using Astropy tutorials with Python interpreter “Jupiter Notebook.”

Below are our results for the locations of FRB and galaxy clusters as queried from the NED database. FRB data, obtained using the same technique outlined in lines 7 through 14 in the Python code above is shown in Figure 4, and cluster data is shown in Figure 5.

![Figure 4](image.png)

Figure 4. Location of FRB signals plotted using Astropy software. Shown are “Mollweide” and “Lambert” projections.

![Figure 5](image.png)

Figure 5. Location of galaxy clusters plotted using Astropy software. Same projections used as in Figure 4. The blank regions correspond to our galactic plane, through which radio signals can’t propagate.
Donna Fleming  
Mentor: Dr. Christopher Martin  
Research in Chemistry  
Department of Chemistry and Biochemistry

**Synthesis of Epoxyketene Precursors**

This project has faced serious challenges from the beginning, but it led to good progress. The upstairs of the Chemistry Building was subject to flooding frequently and we were unable to safely access our lab until this semester. We started by re-analyzing the synthesis pathway, which has changed from the original proposal because diazomethane is very hazardous and we consider that it was better to forego its creation without proper protection – having a blast shield, diazomethane generator, and chemicals was outside of the budget. With the new synthesis pathway, we had some previous intermediates from the previous year which we analyzed for purity level. Therefore, we spent time trying to purify these intermediates.

With a new synthesis pathway established, there was an issue: we could only create molecules with the homo-substituted phenyl rings; meaning we could have very little variety. With the OUR funds, we were able to discover and purchase molecules that allowed us to place multiple substituents on the phenyl rings; this was a major discovery for us. We were also able to purchase NMR solvents that would allow us to analyze the synthesized molecules. In a second step we looked at what wavelength a molecule should be subjected to, in order to be transformed from *trans* to *cis*. Now we are perfecting the second step of synthesis and hope to have results before the end of the year. It is our aspiration that this research project will provide complementary information for further theoretical and experimental studies.
Reliability and Validity of New Test to Measure Anaerobic Power

The research project consisted of the development of a new anaerobic power test to measure anaerobic metabolism in individuals. Anaerobic power occurs in short powerful bouts in the body using the adenosine triphosphate phosphocreatine system. The standard for measuring anaerobic power is the Wingate Anaerobic Test (WanT) performed on a cycle ergometer or stationary bicycle. There is another test commonly used named the Margaria-Kalamen test. For both the Wingate Anaerobic Test and the Margaria-Kalamen, test expensive equipment or specific facilities are required. The WanT test has been validated previously for measuring anaerobic power, and it is considered the “Gold Standard” for these assessments. The test is performed by the subject performing a 5-minute warm-up and then performing a maximal exertion until fatigue lasting 30-seconds. The Health and Kinesiology department was able to provide the equipment I needed to conduct my study. My study consisted of developing a new anaerobic test and validating it with the Wingate Anaerobic test.

The main reasons for developing a new test consisted of the safety of the test, equipment availability, and facilities. My test proposed that all a test administrator needed is a stopwatch and a measuring tape. The study was originally projected to have 30 participants however, I was only able to collect data on 4 participants because of the campus closing in March. The following data was collected; anthropometric data consisting of height, weight, and skinfold measures to calculate percent body fat, anaerobic power collected administering the WanT to validate the new proposed test; and the new test, called the bounding jump test (BJT). The BJT involves the participant performing a countermovement jump forward to take 3 bounding steps forward trying to cover as much distance as possible. Data was collected on five jump trials with at least one-minute rest in between each trial. The trials were recorded with a video camera and analyzed with a video analysis software, (Dartfish v10) measuring the time of the entire jump from start to finish and the distance covered. This time was used in conjunction with the participant’s body mass to calculate power in watts for the jump. After this calculation, Pearson Correlation between new test BJT, and Wingate Test (criterion), was used to establish validity (r= 0.93).
Understanding design features of aphasia-friendly written material:
What matters most to people with aphasia?

The goal of this project was to understand design elements that lead to increased comprehension of written information and to co-construct aphasia-friendly written material relevant to our community. To achieve this goal, focus groups each consisting of three people with aphasia were formed. Participants were recruited from the Aphasia Conversation Lab at Lamar University. To be able to take part in this research project, participants had to be independent and live active lifestyles. In addition, they had to have high levels of comprehension and be able to verbalize opinions and experiences with support. People with cognitive-communicative diagnoses such as dementia were excluded. Each focus group session was recorded and analyzed.

Four sessions were fully transcribed. There were a total of eleven sessions that ranged from 19 minutes to 42 minutes. The total number of minutes was 326 minutes and 38 seconds. During the initial focus group, an open discussion was held with the participants to gather insight regarding the types of written information most important to them and to evaluate different design features that make material less difficult to read. Based on these discussions, a wide variety of materials was narrowed down to three types. These types were political information, information related to health care and restaurant menus. Each weekly session was focused on one of these materials. Design features analyzed were font size, white space, sentence length and word choice.

The research process was collaborative. The participants' opinions guided the manipulation of the text and layout of these written materials to make them more aphasia friendly. An aspect critical for this research is that the participants were active, and their feedback and opinions were essential for the creation of the aphasia-friendly written material. The potential impact this type of study could have on the lives of people with aphasia can be summed up by one of the participants, “We wouldn't have to um be depend on other folks. We could you know go in and make our order.” The results from this study show that the importance of design aspects (e.g., font size, white space) varies according to the type of material. For example, bigger font size is always necessary for materials like wordy healthcare documents but is less important for materials like menus. Another finding from this study is that the use of bullets is almost always beneficial. The goal of this study is to distribute final products (e.g. menus, health related forms) to people with aphasia and gain information on the usability of the products.
How First-Generation Latinx Students Perceive a Higher Education

The perception of the university is expressed differently among students of all backgrounds. A unique population that confronts barriers on their journey through university is Latinx students of first-generation. Their perception of college is an essential factor when considering their pre-existing challenges in a post-secondary institution. The process of enrollment, financial assistance, and emotional support all contribute to the student in their journey to earn a degree. This study revolves around the emerging questions of the experiences of first-generation Latinx students.

Interviewing Process: Once the study received IRB approval, the process of participant recruitment began. Potential participants were sent invitational emails describing the purpose of the study. Attached in the email was the consent form to participate in the study. The invitational emails were sent to a pool of students who met the study criteria. Once the potential participants accepted the invitation to participate, an interview time was scheduled. The researcher interviewed a total of 7 students; 2 African American students, 2 Caucasian students, 2 Latinx students, and 1 Asian American student. The diversity of the students interviewed fairly represented the diversity of the overall student population at Lamar University.

Transcription Process: Once the interviews were completed, the transcription process began. The interviews were transcribed using the qualitative data analysis software, ATLAS.ti. ATLAS.ti was used to transcribe and match the common terms, phrases, and expressions of each interviewee. Once the transcriptions were completed, the researcher sent each transcription to their respective participant. The students were allowed to listen to their interviews as well as read their transcription. If no concerns were brought to the researcher’s attention, the student re-verified permission for their information to be used in the study.

Data Findings: The interviews conducted allowed the researcher to solidify the findings throughout the study. The perception of the university of first-generation Latinx students differs immensely from their non-first-generation peers. Although the purpose of post-secondary education was unique to each student, Latinx students revealed more of an in-debt attitude. The details of this feeling of debt ranged from emotional family expectations to monetary financial assistance. As the students were interviewed, each student shared their experience at Lamar University. Each experience was correlated to their home financial situation. The students who shared the financial need of their family demonstrated the importance of finishing college education. While the students who shared financial privilege tended to show less desperation in receiving a college degree, although all students are continuing their education, first-generation students tend to show fear, uncertainty, and immense pressure in obtaining their education. The findings reveal a correlation between the financial and emotional need of each student to their overall perception of university. The financial and emotional necessities of first-generation Latinx students heavily influenced their overall perception of completing a post-secondary education.
This project planned to take fifty sedentary undergraduate students at Lamar University and have half of them begin an exercise program while the other half remained sedentary. To record the activity level of the participants, we chose to utilize pedometers. We budgeted for fifty pedometers, one for each student participating. These items cost $12 each for a total of just over $700 and were received in late April. We also budgeted for two Garmin fitness tracker smartwatches which we planned to reward one of the participants in each group with out of a random drawing. These were quoted at $100 each and were received prior to the conclusion of the semester. In total, sixteen participants signed up to be a part of the study.

However, for various reasons, several dropped from the study throughout the semester, leaving us with six total subjects. We received complete data sets from four of the participants, two from the exercise group and two from the sedentary group, with incomplete data sets from the remaining two. I compiled the data received into an Excel spreadsheet that includes each participant’s number and the group they were sorted into as well as their daily step counts and, for the exercise group, the duration and intensity of their daily exercise sessions. The spreadsheet also includes the participants’ GPAs which are representative of their academic performance prior to and following the Spring 2020 semester. With so few participants, we cannot draw a definite conclusion regarding the effects of physical activity on their academic performance. However, we plan to continue the project in future semesters in the hopes that we can meet the desired number of participants and use the data to give us better insight into the topic.
Caitlyn Clark and Emily Ingram  
**Mentors:** Dr. Ozge Gunaydin-Sen and Dr. Cengiz Sen  
**Research in Chemistry**  
**Department of Chemistry and Biochemistry**

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**Investigations of Autocatalytic Phenomena**  
*using a Continuously Stirred Tank Reactor and Python Simulations*

In order to better explain the different parts of the project we separate them into several sections. From the original proposal, our mathematical model has been changed from the Brusselator to Oregonator due to the accuracy of this model to the BZ reaction using the FKN mechanism.

**Methods:**  
**CSTR:** With approximately $260 worth of supplies, four micro-scaled CSTRs were assembled. Due to the sizes of the plastic sheets, more than four can be created at $260 at the same price. To build the CSTR, a 0.5”x12”x12” natural polyacetal sheet for the reaction chamber, and a polytetrafluoroethylene (PTFE) 0.06”x12”x12” sheet for the top of the CSTR were cut using the MakerSpace at Lamar. Nathan Rose helped our team cut four reaction chambers and 8 pieces of the PTFE (two pieces = 1 top) sheet at the specified experimental measurements proposed above using the Epilog Laser Fusion(M2) 50 W CO2 laser CNC machine in the Science and Technology building. The steps for building the CSTR is as follows:

To begin, the center chamber and the four flowthrough openings were marked on each side of the CSTR using the corner method with a straight edge. Using a 5-speed 8-inch bench drill press by central machinery with a ½ in forstner bit, the center chamber was made 1 cm deep. (Note: 1 cm deep is the top of the head of the forstner bit) Switching to a 5/8 in forstner bit, a center hole was drilled through the top of the PTFE sheet. A 1/8 in drill bit was used to drill flowthrough holes on the sides of the CSTR (Note: the four openings were marked in Step 1). Next, mark half the distance of the threads of the Delrin nut on the #3 drill bit and drill through the center of each flowthrough hole to marking. Take a crescent wrench with ¼ in-28 NF tap and carefully hand tap by moving the crescent wrench side to side (chasing the threads) and tapping to the bottom of the newly drilled holes. Take an 1/8 in PTFE teflon tubing and put the Delrin nut on first followed by the Tefzel ferrel to fit tubing into tapped holes. Place #40 O-ring at the bottom/on top of chamber then set the concave lens over the O-ring and place the top PTFE sheet on top of the concave lens to mark for self-threading stainless #6 x 1/2 in pan head Philips screws. (CSTR chamber, O-ring, concave lens, top PTFE sheet). Make four holes where they were marked in Step 9 with 1/8 in bit through PTFE sheet. Use the PTFE sheet to mark four more holes on the CSTR chamber then make four holes with 5/64 in bit for pilot holes for self-threading screws.

**Final build:**
Automated Syringe Pumps: Supplies for the pumps cost approximately $400. To build the automated syringe pumps, a 3D printer was used at our MakerSpace. For experimentally use the CSTR, three syringe pumps were needed. Using the “Open-source syringe pump” instructions developed by Michigan Tech’s Open Sustainability Technology Lab on Appropedia and an open source syringe pump design by Joshua Pearce on YouMagine, Nathan Rose was able to print three sets of syringe pump pieces for our team to build the automated syringe pumps. The steps for building the syringe pumps are as follows:

First, we secured the motor into the motor end using four M3 washers and four M3 20 mm screws. (Note: 20 mm screws must be shortened to 15 mm to fit into motor). Next, we inserted two graphite rods (cut graphite arrow shafts) into the motor end then secure them with four M3 washers, four M3 nuts, and two 20 mm screws. For Z coupler replacement: Use ¼ in – 20 x 7/8 in Zinc coupling nuts. We made two locking screw holes for shaft and threaded rod using 8/32 NC tap and drill bit set. (Note: 8-32 x ½ in locking screws must be cut by Dremel tool to appropriate size so that the screws do not hit the motor end while rotating.). We inserted M5 nut into nut-trap on the bottom of the carriage, and attached the base of the plunger holder to the carriage with two M3 nuts and two M3 20 mm screws, then slide the carriage onto the threaded rod and the graphite shafts. After the carriage is midway down the threaded rod, thread two M5 nuts onto the threaded rod. We inserted two linear bearings into the circular slots in the idler end, then slide the idler end onto the rods and secure it with two more M5 nuts on the end of the threaded rod. Finally, we pushed the two nuts already on the rod up to the idler end to secure it. One can insert the syringe body holders behind the idler and secure them with four M3 40 mm bolts and four M3 washers until use.

Final build:

We contacted Dr. James Crutchfield from UC Davis to obtain a Python program written for CSTR simulations using the Oregonator and BZ reaction. The original code was edited to work with Python 3.8, Anaconda and Jupyter Notebook. These allowed for theoretical calculations and simulations. The modified Python code was run to ensure the results were the same as the literature. There were high flowrate and low flowrate simulations tested, which are both associated with a set of parameters and a range of the bifurcation parameter, kr. The bifurcation parameter is defined as the inverse residence time, or how long a substance stays in the reactor, in (s⁻¹). Flow rates were not specified but were defined by their relationship with the bifurcation parameter. In Jupyter Notebook, the Python code could be changed for the concentrations of the reactants, which are represented by A= Bromate Ion (BrO₃⁻); M= Malonic Acid; H= H⁺; C= Cesium ions (Ce). However, the Python code solves for the BZ reactions, calculates the outcome of such reaction and then plots them against each other. The resulting compounds are Bromous Acid (HBrO₂), Cesium (IV) (Ce(IV)), and Bromomalonic Acid (BrMA). Using an add on in Python, Mayavi Scene, allows for a 3D simulation of the 2D plot. Understanding the chaotic factor and what the theoretical results are, can help us to gauge how much of each reactant is needed to produce different types of chaotic oscillations. Because the BZ reaction is a stiff ordinary differential equation.
(ODE), elaborate integration was required using an integration package, SciPy, that incorporates variable step-sizes for stiff ODEs based on a set of Fortran ODE solvers, called “odepack.” These step-sizes can be changed, which relates to the amount of iterations that are carried out to try to solve the system, or try to reach an equilibrium state. In the Python code, $\alpha, \beta$ which are constants set to solve BZ reaction. Moreover, in the simulations the only things that were changed were the concentrations, the $k_f$ and the step size. It should be noted that in the Python simulation, Cesium ions are used, but in our experiment, we planned to use Ferroin ions. These can be applied in the same manner to the reaction for oxidation.

The following graphs are preliminary tests of the modified Python Code to ensure it match literature results:

![Onset of Chaos](image1)

Figure 2: Concentrations: $A=0.1M, M=0.25M, H=0.26M, C=0.000833M$. Low flowrates and a small $k_f$ value results in a nearly 2D plot. The system beings as if confined, and then begins to disperse, following the same spherical-like pattern.

The following graphs have changes in concentrations.

![Concentration](image2)

Figure 3: Concentrations: $A=0.01M, M=0.7M, H=0.24M$ and $C=0.39M$. The results from a stark decrease in Bromate ions and an increase in Cesium ions resulting in the Cesium ions (green) now portraying their own oscillatory characteristic in some parts of time. There also appears to be more of a defined chaos that never reaches an equilibrium.

![Concentration](image3)

Figure 4: Concentration: $A=0.78M, M=0.12M, H=0.24M$ and $C=0.00039M$. The concentration of Cesium ions was decreased, and a lower $k_f$ value. It is hypothesized that once the reaction completes, the compounds reach equilibrium once again. If the time were extended and the amount of iterations allowed to continue, another chaotic oscillation pattern may have occurred.

The results of the Python simulations were meant to be theoretical results to help guide us in doing the hands-on experiment in the lab. The effects of each concentration in Python would have allowed us to determine the optimum concentration required for gaining results at specific flow rates. While these experiments were not able to be carried out, we appreciate the opportunity, nonetheless, to acquire the knowledge that we have gained in what theoretical and mechanical experimentation that we have done.
David Halnon

Mentors: Dr. Phil Cole and Dr. Jim Jordan

Research in Physics

Department of Physics

Quantitative Optical Gas Imaging

Remotely Quantifying Hydrocarbon Leaks.

This project focuses on the use of Long Wave Infrared (LWIR), or thermal, cameras to detect and quantify hydrocarbon gas leaks. David Halnon was brought onto the project May 2019 to assist Jared Richards in all areas of the project, beginning with the development of a method to consistently, predictably, and safely simulate gas leaks using a CONCOA gas pressure regulator controlling releases of a mixture of air and methane. Verifying the accuracy of the regulator was difficult, as the exit velocity of the gas was too low for many anemometers. Eventually we were able to verify the exit velocity when using 100% air mix with a hot wire anemometer, however we decided that it was unsafe to use this with a methane/air mixture.

The next step was to design and build the lab in which methane could safely be released, this involved the construction of a custom fume hood. As it stands now, the fume hood is complete, however unusable due to the lack of a suitable power outlet in a location the fan can be placed. This was going to be rectified by ICI early this year, but the COVID-19 outbreak caused progress on the project to grind to a halt.

I used the extra time the delays in constructing the lab gave me to familiarize myself with MATLAB’s image processing toolbox and found two types of image analysis to use to analyze the data once collection can begin. The methods I have explored are velocity fields, in which I construct a velocity field where I can measure the difference in velocities of the edges of the plume of gas with the velocity of the center and find the Reynolds number of the flow, which can be used to find a mass flow rate, and block matching, which will predict the motion of individual parts of the plume and highlight the differences between the predicted motion and the actual motion.
The extracellular eukaryotic parasite Trichomonas vaginalis (Tv) causes a highly prevalent sexually transmitted disease worldwide. This parasite has also been correlated to an increased susceptibility of cervical and prostate cancer. Therefore, understanding the innate immune defense mechanisms from the pathogen due to the increase in immunodeficiency from Tv is critical. The working hypothesis for this research proposal was that the prolonged infection of Trichomonas will result in a low-grade to severe inflammatory response towards the epithelial cells, which will pre-dispose cells to the onset of cancer. This experiment was proposed due to more knowledge and research needing to be conducted to better understand the parasite in its correlation with cervical cancer. As little progress had been made towards the etiology of cervical cancer, the goal of this proposal was to investigate the inflammatory response of HeLa cervical cells in response to an interaction with Trichomonas cells. The research project is not currently complete to give the finalized results due to COVID-19 disruptions.

The following materials were purchased: The Caspase-3 colorimetric assay kit, the Apoptosis inhibitor, the Falcon tissue culture treated flask, and the Nunc Lab-tek Flask on Slide. The experimental setup was commenced by first initiating the cell culturing of Trichomonas cells and creating a standardized growth curve for them. The HeLa cervical cells were grown and later generated into freezer stocks. These freezer stocks are now being used in the experiments to determine the interactions and their response using the cytokine assay kits. During the interactive studies, the cytokine response will be recorded from the HeLa cervical cells. These results would then be compared between two different isolates of Trichomonas. After being able to commence work again, this part will be completed and analyzed for the results using the procedure of isolating RNA from cells. The remaining of the research project will be completed to produce the data of the cytokine gene expressions, and record which ones are pro-inflammatory cytokines.
Effect of *Akkermansia muciniphila* on intestinal epithelial cell integrity upon interaction with other common gut-bacteria

The project’s goal was to test the specific effect of co-interaction of *Akkermansia muciniphila* with other common gut bacterial species on epithelial integrity using Caco-2 epithelial cells as a model to delineate the changes in the inflammatory responses of the host epithelial cells. It has been experimentally tested that *A. muciniphila* binds protein laminin and undifferentiated Caco-2 cells, therefore, the hypothesis of this project is that in an epithelial-like cell (with breaks in its integrity), presenting *A. muciniphila* will bind laminin to the breaks which will prevent entrance of other intestinal bacteria into the Extracellular Matrix (ECM). The results from this study will be important to understand the influence of various diet and how it can alter the gut-microbial population affecting epithelial lining.

The project required specific bacterial culture, molecular reagents, and cell culture reagents. The reagents included Defibrinated Sheep Blood and a brain-heart infusion agar plate with 5% sheep’s blood. We also used an AnaeroPack rectangular jar and gas generator packaging since *A. muciniphila* is strictly anaerobic. My mentor helped me establish cell culture techniques for HeLa cells and CaCo-2 cells. We grew these two cell lines from a freezer stock from ATCC. We also prepared media and plates for the *A. muciniphila* bacterial cells. We performed two sets of interactions, one aerobically and another anaerobically. The interactions were between *A. muciniphila* with *Escherichia coli*, *A. muciniphila* with *Enterobacter aerogenes*, and a mixture of all three bacteria.

In conclusion, our hypothesis was proven correct, presenting *A. muciniphila* bacterial cells on to epithelial-like cells such as Caco-2 cells kept the epithelial lining intact. We also learned that Caco-2 cell linings remained in much better shape when *A. muciniphila* was present with the other gut bacteria.
Results using Bright-field Microscopy

Monolayer of Caco-2 cells with *E. coli*

Monolayer of Caco-2 cells with *A. muciniphila, E. coli, and E. aerogenes*.
Fabrication of Superhydrophobic Aluminum Surfaces

The research was conducted with the goal of creating superhydrophobic microstructures on aluminum sheets. The first task was to correlating laser etching parameters with the resulting geometry to enable the creation of prescribed microstructures. The prescribed microstructure for the first round of tests was an evenly spaced grid of square protrusions 100μm on a side with 200μm gaps between them. Forty-two samples were created to characterize the microscopic effects of etching on the structure of the sample surface. The first data set collected consisted of twenty-one samples and sought to correlate both power and scanning speed with resulting geometry. The sample-set was arranged with three rows, A, B, and C, corresponding to 30, 40, and 50% power, respectively. The set was further divided into seven columns corresponding to scanning speeds of 50, 100, 300, 500, 1000, 3000, and 5000 mm/s, respectively, to cover the full range of the equipment. Every sample was created using an array of hatchings to include the full width of each cut as the effective width of the laser’s cut was not sufficient to cover the spacing in a single cut.

The best results were found in the sample with 40% Power and 1000mm/s scanning speed. The second sample set consisted of twenty-one more samples and sought to correlate and power and number of passes. The prescribed pattern for these samples sought to find the densest structure the equipment could produce, keeping the same proportions as the previous trial. This was achieved with a grid of protrusions 20μm on a side with 40μm gaps between them created by single hatching. The sample-set was divided again into rows corresponding to 30, 40, and 50% power. This range was split into seven columns with the number of passes corresponding directly to the number of passes used. The second task of the research project was to link the surface geometry with its hydrophobic properties. Three samples were created with 40% power and 1000 mm/s scanning. Theses sample used 5, 10, and 15 passes, respectively. The results of these test proved the structure were hydrophobic with contact angle well above 90° and in fact bordered on and in one case surpassed the superhydrophobic threshold at 150°.
Exploring Light Dependence of Sulfide Oxidizing Microbial Communities in Southeast Texas Coastal Marsh

Our project set out to test what role light plays in the oxidative process in the microbial communities in our local saltmarsh. We hypothesized that aerobic chemoautotrophic sulfide oxidizing bacteria are dominating in the pools exposed to sunlight due to a supply of oxygen from oxygenic photosynthetic microbes which aren’t present in the pools shaded with vegetation.

To begin, the first step in our research project was to venture out into the marsh and locate our sites. On this same field trip, we took readings using a light meter to determine the average amount of sunlight at each type of site location. We used leftover PVC and window screening to fabricate our light shades, layering a shade over the PVC to mimic natural levels of sunlight. After fabricating our shades, we went back to the marsh to place them at the appropriate sites. During that trip, we also began our samplings by collecting environmental parameter data and water samples. Since sulfide levels were critical in our experiment, we performed the sulfide reaction in the field to mitigate any reaction with oxygen, which could impair results. In the lab, we analyzed the initial sulfide reactions using a spectrophotometer. For our final sampling, along with our water and environmental data, we also collected sediment and biofilm debris from each treatment site. These samples were meant for later DNA extractions and sequencing. We then processed the sediment and biofilm samples and extracted the DNA. Once extracted, it was shipped off to be sequenced. After receiving the sequencing data, we generated plots and graphs to show the change in the microbial community among different treatment types. We found that each of our treatments shifted the microbial environment toward that of the control. The pools which were artificially shaded increased the number of phototrophic SOBs and cyanobacteria and reduced the number of eukaryotic algae and chemoautotrophic SOBs. It is evident that the change in the phototrophic SOBs suggest that they have a preference for shaded conditions. The chemoautotrophic SOBs relative abundance increased in the pools opened to sunlight. These SOBs favor growth with oxygenic photosynthetic algae.
Accurate Methods Based on Molecular Rotational Resonance (MRR) Spectroscopy for Fast Detection of Polar Impurities in Petroleum Mixtures

Molecular rotational resonance spectroscopy is a high-resolution analytical technique that identifies and quantifies chemical species in a mixture by relating MRR spectral patterns and molecular geometry in a complex mixture. The key technical advantages of MRR over conventional technique include the extraordinary chemical specificity, information richness, fast experimental measurements, and calibration free capabilities. As a part of the effort to extend the MRR applications to petroleum industry, the LU Benchtop MRR technique was examined for fast detection of small polar impurities in crude oil. The unique goal of this project was to develop a robust analytical procedure based on MRR technique for fast detection of polar impurities in petroleum mixtures.

Our research efforts therefore have been led by the following three important objectives:

1) **Operating the LU Benchtop MRR Spectrometer**- This was an essential step to kick-off our research project but it came with some struggles; especially for understanding the mechanical operation of Molecular Rotational Resonance technique. This round of efforts provided us with an opportunity to work on sample preparation and transfer, and data collection and analysis using MRR spectrometer.

2) **Purchasing chemical and material supplies**- Based on the technical skills established in (1), we began to work on our research plan by purchasing all required materials. These include gas tight syringes, (Fisher Scientific, $90.00), moisture trap (Fisher Scientific, $215.00) for reducing water moistures, and West Texas crude Oil. We also purchased Igor Pro-8 software (Wave Metrics, $525.00) to be able to manage and categorize data while under the COVID-19 stay-at-home orders. This allows us to continue our project, despite the unfortunate events keeping us from the laboratory.

3) **Collecting preliminary data**- Using the available resources and materials, we measured MRR spectra of crude oil in the 20-23GHz frequency range. The resulting spectrum, which is shown in Fig.1 (below), is an average of 100K broadband scans recorded at 8-10mTorr pressure. The analysis of the present data reveals the presence of multiple polar impurities due to the sensitivity of the MRR to only small polar species. The
hydrocarbon matrices that typically obscure these small polar impurities are nearly eliminated as a result of the increased specificity of the MRR spectrometer. Prior to the ongoing crisis (COVID-19), we had a plan to work on the improvements of the current sensitivity and reproducibility of the data. Specifically, we wished to optimize our MRR spectrometer and apply it on select target measurements to evaluate the MRR linearity and reproducibility. Also, we will explore the use of calibration gases to confirm the presence of certain polar impurities in the crude oil. Such measurements will be essential to confirm or deny the MRR applications in petroleum industry.

Fig. 1: MRR Spectrum of crude oil recorded using a benchtop K-Band spectrometer in 20-23 GHz frequency range. The zoomed MRR spectrum reveals the presence of small polar impurities due to MRR’s sensitivity.
Kimanh Tsan  
**Mentor: Dr. Matt Hoch**  
**Research in Biology**  
**Department of Biology**

### Microbial Response to and Environmental Fate of Starch-Copper Oxide Nanoparticles in an Aquatic Ecosystem

Increasing applications of copper oxide nanoparticles in agriculture and technology demand research into its potential toxicity to human and environmental health, its influence on microbial communities, and the fate of these nanoparticles in the natural environment. This research aims to understand the microbial enzymatic degradation of and microbial community response to exposure of starch-copper oxide nanoparticles (SCuONP) in rice crop irrigation waters. Two hypotheses were considered: 1) glucose and glucuronate in crude SCuONP initially inhibits degradation activity of α-glucosidase but selects for growth of taxa that degrade starch, 2) high concentrations of dialyzed-SCuONP will have greater α-glucosidase activity, bacterial growth, and change in microbial community than in controls and low dialyzed-SCuONP treatments.

Starch degradation was measured in triplicate incubations of control, low dialyzed (30 µM CuO), high dialyzed (300 µM CuO), and low crude treatments (30 µM CuO) over a 5-day period. α-glucosidase activity was similar between control and dialyzed treatments. Low crude treatment α-glucosidase activity was initially inhibited on Day 1; however, there was a 50-fold increase in α-glucosidase activity compared to other treatments by Day 3. DNA was extracted and sequenced, and Quime2, a bioinformatics software, was used to analyze microbial communities of the treatments. The low crude treatment had the least phylogenetic diversity and the most community difference. Observing prokaryote family relative abundance, the control, ambient, low / high dialyzed treatments had similar bacteria taxa and percent abundance of family level bacteria taxa; however, the low crude treatment had a high percent abundance of Flavobacteria, a known degrader of starch and other biopolymers.

The crude SCuONP contain glucose and glucuronate which enrich for bacterioplankton that can express high α-glucosidase activity; this could possibly result in degradation of starch and release of CuO. Flavobacteria had a predominant presence in the low crude treatment, and the variation in its relative abundance corresponded with starch degradation activity. Relative abundance of Flavobacteria was greater in dialyzed treatments compared to control possibly due to starch in SCuONP. The low and high dialyzed treatments did not have greater α-glucosidase activity relative to the control. Although α-glucosidase was similar between controls and dialyzed treatments, there was a small but significant change in microbial community of the high dialyzed treatment compared to control and low dialyzed treatment.
Chemicals and materials used for this research project includes beta-amyloid, broth and agar used as media to grow bacteria on, plates and slides, as well as other standard supplies. The amyloid-β (Aβ) peptide accumulation is associated with Alzheimer’s disease. There is a correlation between Aβ aggregation and the progression of Alzheimer’s disease. In order to determine whether or not an infection accelerates Aβ aggregation, we used *Escherichia coli* (*E. coli* and its product curli) and *Staphylococcus epidermidis* (*S. epidermidis*) to study Aβ aggregation and toxicity. In this experiment, we performed serial dilutions and had different conditions to measure the effect of Aβ on bacteria: a set with just bacteria a control, a set with bacteria and Aβ, a set with bacteria and antibiotics, and a set with bacteria, antibiotic and Aβ. In addition, fixed bacteria slides have also been made and Gram-stained to investigate Aβ aggregation in the presence of bacteria under the microscope. Based on the observation, we did not see a significant change in *E. coli* growth in the presence and absence of Aβ. When the bacteria *S. epidermidis* is introduced into a media with Aβ, no bacterial growth is seen on any of the plates. This evidence provides support on the hypothesis of the Aβ antibacterial effect against *S. epidermidis* but not *E. coli*. However, more study is required to conclude the antibacterial effect of Aβ peptide against *S. epidermidis*.

I am very grateful to have had the opportunity to work on this experiment. The OUR grant has given me the chance to be able to conduct my very own research project and I can confidently say I have gained a considerable amount of experience and knowledge. This was the very first time I organized and managed my own project in a laboratory setting and it gave me the confidence to make my own decisions and think analytically. I made everything from scratch and learned how to prepare tryptic soy broth and agar plates. I went through training on how to use the autoclave and practiced my aseptic technique on the daily. I also gained more experience in previously learned microbiology techniques such as performing serial dilutions, plating, Gram-staining, observing cells on slides as well as counting colonies. I also learned how to collect the data and record it. This experiment has taught me how to manage my time and go through trial and error to make an experiment work, without thinking that it’s for a grade but rather to successfully perform the scientific method. Through this project, I have learned about Alzheimer’s disease pathology and the possible relation between chronic infection and the progression of Alzheimer’s disease. I learned to think independently and to develop my own opinions supported by existing evidence. I can confidently say the OUR grant has been very beneficial to my education and journey at Lamar University and will help me in my future in graduate school.
Colby Fore  
**Mentors: Dr. Richard Condit and Dr. Bryan Proksch**  
**Research in Music**  
**Mary Morgan Moore Department of Music**

*An Undergraduate Perspective on Jazz Education and Performance: Musical and Personal Development*

My objective was to conduct interviews with jazz saxophone luminaries Bob Mintzer and Dick Oatts while volunteering at the 11th Annual Jazz Education Network Conference with the goal of publishing an article about jazz’s uniqueness as it relates to personal growth. Bob Mintzer was unable to attend the conference, so I was able to get an interview with another saxophone giant, Bob Sheppard, as a substitute.

The interviews were in relaxed conversational setting. With one of the interviewees, we also covered some playing in a "private lesson" setting in addition to the interview. With the verbal approval of both interviewees, I vocally recorded both conversations. I would consider both a success! I am currently drafting the article.

Because the two interviewees are professional performers and educators in the public sphere, I conducted the interviews with the goal of publishing an article featuring their insights. I have signatures of both candidates on an “Informed Consent” document. No pictures were taken of the participants.
Does mindfulness awareness improve college students' task performance?

My research topic for the OUR grant 2019-20 was mindfulness. Mindfulness is the ability to maintain awareness of one’s surroundings, thoughts, and feelings. Unwanted intrusive thoughts affect the daily lives of college students and eliminating these thoughts can potentially assist the mental well-being of students. Through research, I wanted to explore if mindfulness-awareness improved college students’ task performance. The materials I required for this research were noise-canceling headphones. All the budget expenditures were finalized before February 15, 2020.

The research was conducted in the Social and Behavioral Sciences computer lab, in which participants were required to come in during their designated time slots. In this study, male and female participants were randomly assigned to engage in a mindfulness-awareness meditation or a control activity by watching videos. Participants’ task performance was measured and compared. The tasks measured in the study were daily academic questions such as critical thinking, mathematical computations, and analytical reasoning. Additionally, the mindfulness activities’ duration was about ten minutes. The total number of participants in this study were 90 university students. There were 16 (17.8%) males and 74 (82.2%) females. The average age of participants was 20.74 years. The overall data showed that there were 27 (30.0%) freshmen, 42 (46.7%) sophomores, 17 (18.9%) juniors, and 4 (4.4%) seniors. There was no significant difference for the type of video shown to the participants, $F(1, 86) = .194, p = .661$. There was also no significant difference between male or female participants, $F(1, 86) = 2.883, p = .093$. Lastly, there was no significant interaction between the type of video watched and gender, $F(1, 86) = .049, p = .825$.

The results of the study are shown in these graphs:

There were 8 male participants and 37 female participants that watched the Stress Relieve/Meditation video and the Psychological Facts video.
OTHER RESEARCH PROJECTS DONE OVER SUMMER

Viviana Denova
Independent Research
Mentors: Dr. Gevorg Sargsyan and Dr. Kabir Sen
Research in Business Management
Department of Economics and Finances

In the spring semester I decided I wanted to gain experience in undergraduate research. Since I was late to apply for any type of funding, I reached out to faculty who were already working on projects. I was able to work on two projects with Dr. Gevorg Sargsyan and Dr. Kabir Sen. What helped me be successful is that I had motivation to learn about what I was researching. I learned about Spain and its economy and compared it to certain regions of Texas. **Viviana will present two short talks:**

1. **The Economic Impact of Tourism on the Texas Gulf Coast and Costa Blanca**
2. **Role of Small and Medium Enterprises on the Economy of the Alicante Province and the Southeast Texas**

Daniel Quispe
Research Experience for Undergraduates (REU)
Mentor: Dr. Jian Cao from Northwestern University, Material Research Science and Engineering Center
Research in Material Sciences
Department of Mechanical Engineering

My undergraduate research journey began in my first semester of university when my older brother and I received an Office of Undergraduate research grant to conduct solar cell research. This introductory research experience cemented my determination to contribute to the effort made towards solving our world’s energy reliance on fossil fuels. Since then, my interest has matured as I continued working on this research project and applying to opportunities to help fund it. Thanks to the support from the McNair Scholar Program, I was able to continue the solar cell research throughout the summer of 2019. My curiosity in observing how weather conditions can affect the efficiency of solar cells led me to construct various indoor setups to evaluate the photo-power production efficiency of solar cells when under lab simulated weather conditions.

Thanks to my efforts and guidance from my mentor Dr. Cristian Bahrim, I was able to present the results at several professional gatherings. These gatherings consisted of Texas Undergraduate Research Day at the Capitol, the Undergraduate Research Conference hosted by the Ronald E. McNair Scholars Program (Buffalo, NY), and the Gulf Coast Undergraduate Research Symposium hosted by Rice University. These experiences have served to open up many pathways that will help to further my knowledge of solar cell research and ultimately prepare me for graduate school. From these experiences, I determined that the next stepping stone in my goal in preparing for graduate school was to participate in a Research Experience for Undergraduates (REU). I knew that by participating in this competitive nationwide opportunity, it would provide me an irreplaceable opportunity that would allow me to transition from my current undergraduate level of research towards experiencing research at a world-class level. In the summer of 2020 I was selected to participate in an REU with Northwestern University's Materials Research Science and Engineering Center. I worked under the guidance of Dr. Jian Cao, and my project looked to the mesoscopic characterization of triaxial braid composite fabrics with yarn angle variations. In working on this project and attending faculty talks throughout the summer, I was able to broaden and enrich my knowledge of professional research.

**Daniel will present the talk on The effects of yarn variations on triaxial braid composites fabrics**
GET INVOLVED!

Upcoming dates for conference, events & more!

OUR GRANT 2020-21
APPLICATION DEADLINE: OCTOBER 10, 2020

8TH ANNUAL TEXAS STEM CONFERENCE
OCTOBER 24, 2020

7TH ANNUAL HUMANITIES, ARTS, SOCIAL & BEHAVIORAL SCIENCES, EDUCATION & BUSINESS (HASBSEB)
NOVEMBER 21, 2020
ANNOUNCEMENTS FOR FALL 2020

Rice is hosting the Gulf Coast Undergraduate Research Symposium (GCURS) for the 12th year in a row and would like to invite interested students to apply at gcursapply.rice.edu. This year, the symposium will be on Saturday, Oct. 31 and will be held entirely virtually! The application deadline is Oct. 5.

The conference website is at https://gcurs.rice.edu/
ANNOUNCEMENTS FOR SPRING 2021
WITH SUBMISSION DEADLINES IN FALL 2020

PLEASE CONSIDER APPLYING TO THE FOLLOWING EVENTS

THE UNDERGRADUATE RESEARCH DAY AT THE CAPITOL IN AUSTIN

POSTERS ON THE HILL IN WASHINGTON D.C.

THE NATIONAL CONFERENCE FOR UNDERGRADUATE RESEARCH

AND PLAN TO JOIN

EXPO 2021 AT LAMAR UNIVERSITY
JOIN OUR STUDENT ORGANIZATION
LAMAR UNDERGRADUATE RESEARCH ASSOCIATION (LURA)

“LURA was founded in fall 2019 to fulfill the need for a community by and for undergraduate students to discuss, collaborate, and learn how effectively one can conduct research. The consistent quality and volume of research conducted by undergraduate students at Lamar University has made it clear that there is a need for an organization to act as a vital resource for building young researchers. Thus, LURA provides an academic forum that connects all level students from freshmen to seniors with their professors and mentors, and facilitates communication between Lamar undergraduates and their peers around the nation.

LURA is a platform for offering panel discussions about
- Research opportunities inside and outside Lamar,
- Better ways to deliver undergraduate research results in poster and oral presentations,
- Ways to perform peer mentoring,
- Organizing workshops on various topics, including how to successfully apply to graduate schools.

LURA is the premier student organization at Lamar University for any undergraduate student interested in doing research. The Office of Undergraduate Research provides strong support and offers logistics to this student organization.” Please contact UURALamar@gmail.com or visit the Office of Undergraduate Research

PANEL DISCUSSION

Prepare your next O.U.R. Research GRANT (fall 2020-spring 2021)

All LU undergraduates, faculty & staff are cordially invited to join a virtual O.U.R. Panel Discussion (using a Zoom platform)
Friday – October 2, 2020
1:30 to 3:30 p.m.

We cordially invite you to join our casual conversation held by former OUR grant recipients for gaining information on how to become an OUR grant winner.

The awardees will receive these benefits:
- $500.00 stipend
- Up to $1,000.00 in research support!
- Have the opportunity to present their research at Expo 2021!

The session is hosted by the Director of O.U. R., and has five panelists: Donna, Fleming, Tyler Martin, David Martinez, Lauren Ocnaschek, and Daniel Quispe.
The Advisory Board of the Office of Undergraduate Research has decided by scoring all presenters, who are the winners of The BEST PRESENTATIONS Awards at EXPO 2020.

From the 2020 OUR grant cohort, the winner for the HASBSEB area of research is

**Anna Sigur**

*Mentor: Dr. Jamie H. Azios*

*Project in Speech and Hearing Science*

*Title: "Understanding Design Features of Aphasia-friendly Written Material: What Matters Most to People with Aphasia?"*

From the 2020 OUR grant cohort, the winner for the STEM area of research are

**Caitlyn Clark & Emily Ingram**

*Mentors: Dr. Ozge Gunaydin-Sen (in photo) & Dr. Cengiz Sen*

*Project in Chemistry and Physics*

*Title: “Investigations of Autocatalytic Phenomena using a Continuously Stirred Tank Reactor and Python Simulations”*

The best video presentation in the STEM area goes to Daniel Quispe.

**Daniel Quispe**

*Research Experience for Undergraduates (REU)*

*Mentor: Dr. Jian Cao from Northwestern University, Material Research Science and Engineering Center*

*Research in Material Sciences*

*Department of Mechanical Engineering*

Daniel was 2020 REU fellow at Northwestern University, during this past summer. He is invited to give a special talk at the 8th Texas STEM Conference, on October 24, 2020.